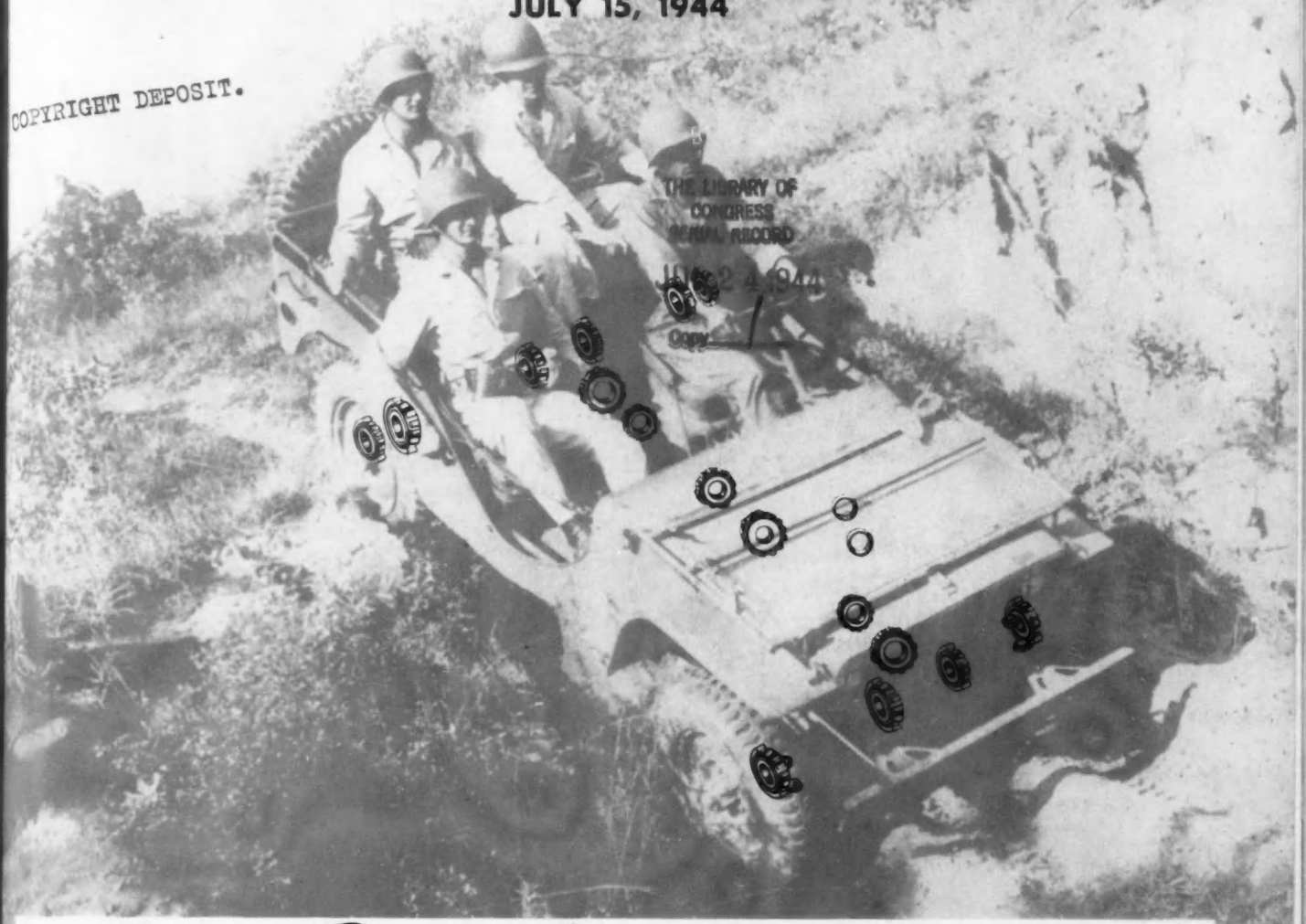
AUTOMOTIVE and Aviation INDUSTRIES

JULY 15, 1944

COPYRIGHT DEPOSIT.



THE LIBRARY OF CONGRESS
SERIAL RECORD
JUL 24 1944
Copy 1

Sure Footed AS A PACK MULE

When army engineers laid down the specifications for a universal personnel car they had only certain basic requirements in mind. Most of the details were left to the experienced hands of the motor vehicle builders. No one denies that it is a success. Literally, it will go practically anywhere, do anything, sure-footed as a pack mule and reliable as the 24 Timken Bearings which are in the wheels, steering parts, differentials and pinions.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

JUL 24 1944

Meet Specific requirements of every job

ON VERSATILE HEALD BORE-MATICS

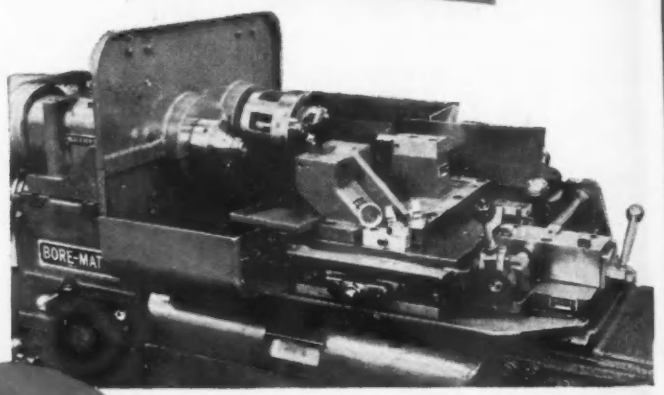
Adjustable Boring Head Mounting on Slotted Bridges.
Flexible V-Belt Head Drive Gives Wide Speed Range.
Available with Single End or Double End Bases.
Hydraulic Table Drive permits complete range of feeds.
Units of Hydraulic Box readily changed for various cycles.
Auxiliary Hydraulic Power for Cross Slides, Tool Slides, etc.
Plus
Flexible Cycles — Manual or Automatic

V. F. 2* ALL-PURPOSE VERSATILITY FROM BASIC BORE-MATIC DESIGN

BORIZE ON BORE-MATICS . . . that means improved results on all operations . . . means better accuracy, finish, production for boring, turning, facing, chamfering, grooving, fly cutting, for straight and taper surfaces, for curves and irregular shapes.

All these operations would not be possible on a machine with fixed, rigid design. On Heald Bore-Matics, basic design is unusually flexible . . . has unusual versatility that permits individual arrangement to suit specific requirements of every job.

Versatility like . . . slotted bridges holding one or more boring heads for single or multiple operation . . . flexible, adaptable drive to heads by V-belts . . . single end or double end bases for single end or double end operations . . . hydraulic feeds, infinitely variable . . . auxiliary hydraulic power to operate cross-slides, tool slides, tool back-off clamping . . . machine cycles, manual or automatic to suit your requirements. Get the facts on Heald Bore-Matics now. Write The Heald Machine Co., Worcester 6, Mass.



LOOK FOR
*V. F.
"VERSATILITY FACTOR"
In your Post War Tools

V. F. 1 — Application
V. F. 2 — Function
V. F. 3 — Tooling
V. F. 4 — Fixtures

This is *functional* versatility. Heald engineers took a standard basic single end Bore-Matic, mounted two heads on the bridge with special rotating fixtures, designed special tools, put them on a hydraulic cross-slide. Final result . . . completely automatic turning, boring, facing, necking, forming of bearing liners in two-stage progressive operations.

HEALD *Bore-Matics*

THE MOST VERSATILE MACHINE TOOL

Battle-front Refrigerators

ON WHEELS!

Acme Photos

The Waukesha Portable Cooling Unit mounted in front trailer compartment. Under-body installation also provided to give maximum cargo space.

● It isn't *always* K rations up at the front lines. Not when these G. I. refrigerators go rolling along. Here are some of them on the move in the European area.

No matter how long the supply line to the front may be, their loads of fresh meat and green vegetables, life-saving blood plasma and other precious medical stores will arrive in prime condition. The Waukesha Engine-Driven Refrigeration Unit takes care of that. Dependability is built in—and how well Waukesha *knows how* to build it in.

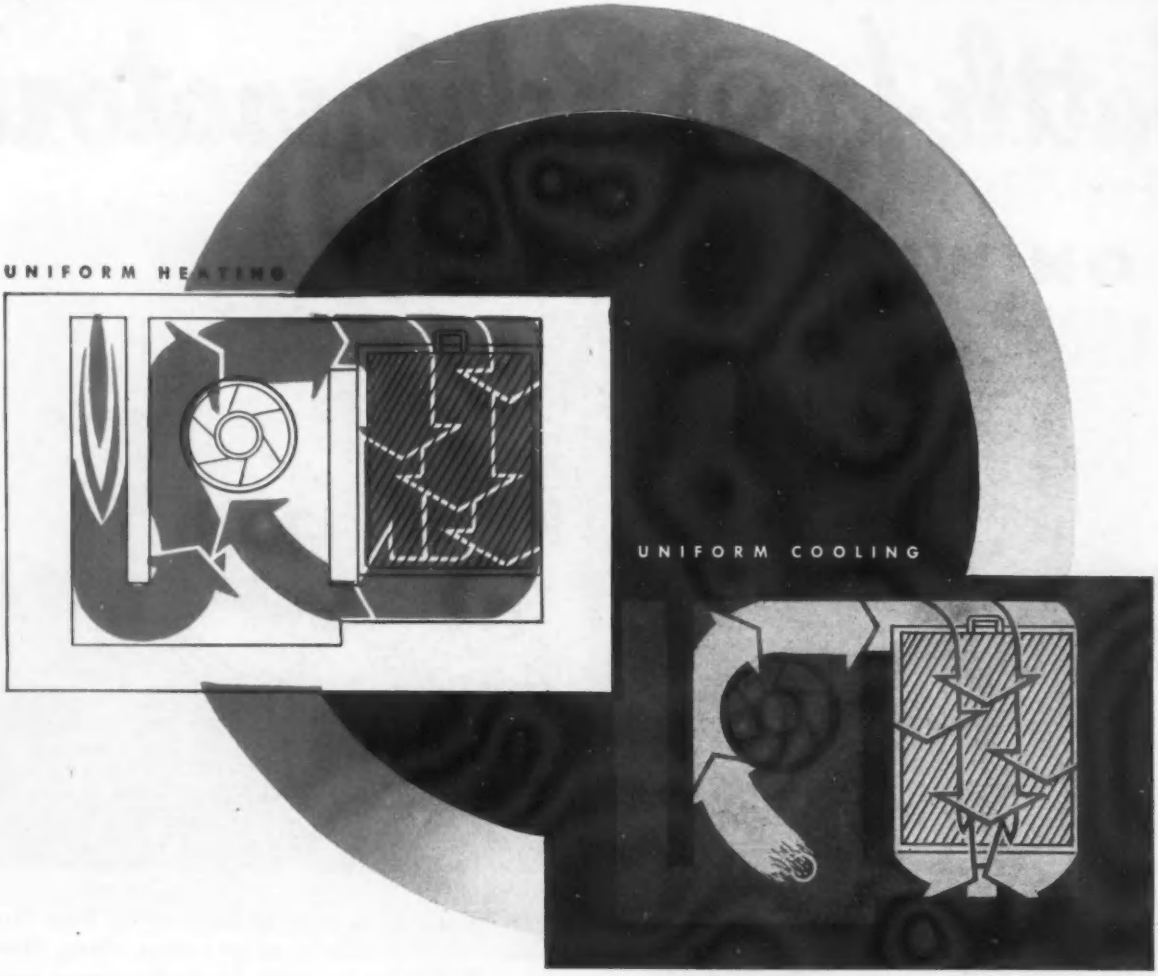
Waukesha *know-how* was gained from years of building mobile engine-driven air conditioning and refrigeration equipment. Equipment that proved its dependability over millions of railway and highway miles—despite constant variation, sudden changes and wide extremes of temperature.

Today all Waukesha *know-how* goes into the war effort—and all Waukesha production goes to the armed forces. After the war Waukesha mobile engine-driven refrigerating units . . . still further proved *and* improved . . . will be ready for mobile commercial applications of every type.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. • NEW YORK • TULSA • LOS ANGELES

MORE POWER FOR VICTORY

WAUKESHA ENGINES



Cycle heating *and cooling* is positive with the Lindberg *Super-Cyclone*

Most versatile furnace in the heat-treating industry, the operating principle of the Lindberg Super-Cyclone allows accurate control of cooling as well as heating. For cycle-heating and cooling, an "automatic program control" can be set up for entire operations without the charge being withdrawn from the furnace.

The amazing Lindberg principle of fan driven hot air from an isolated heat source makes such flexibility possible. Just as the load is evenly heated throughout with rapid uniformity, it can quickly be cooled by cutting the heat and continuing the blower. Thus air at room temperature is forced through the charge, cooling evenly every piece throughout the load.

Cycle-annealing, spheroidizing or isothermal transformation is a quick and accurate operation with the Lindberg Super-Cyclone.

After a soaking at any temperature, the automatic program control will quickly bring down the entire charge to a given temperature for another heat. This remarkable furnace does work faster with a minimum of correction, saves a vast amount of time, floorspace and man power, and provides, in the same furnace, normalizing or annealing, hardening, or tempering. Write to Lindberg Engineering Company, 2446 W. Hubbard St., Chicago 12.

ARMY E NAVY

Lindberg FURNACES

SUPER-CYCLONE for hardening, normalizing, annealing, tempering

CYCLONE for accurate, low-cost tempering and nitriding

HYDRYZING for scale-free and decarb-free hardening

AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Vol. 91 July 15, 1944 Number 2

JULIAN CHASE, Directing Editor

J. R. CUSTER, Associate Editor — JOS. GESCHELIN, Detroit Editor
JEROME H. FARRIS, Ass't Editor — E. L. WARNER, JR., Associate Editor
MARCUS AINSWORTH, Statistician — H. H. ROBERTS, Ass't Editor
L. W. MOFFETT, Washington Editor — HOWARD KOHLBRENNER, Art Editor
J. D. BROWNE, Washington News Ed. — EUGENE J. HARDY, Washington Ass't Ed.
R. RAYMOND KAY, West Coast — MARCUS W. BOURDON, British

CONTENTS

Net Sales of 16 Vehicle Companies at New High—$7 Billion in 1943. *By Marcus Ainsworth* 17

Ex-Cell-O Fuel Injection Equipment in Production. *By Joseph Geschelin* 20

The Army Weasel—a Studebaker Product 23

Natural Gas, Coal and Shale Oil Reserves Ensure America's Gasoline Supply. *By W. C. Hirsch* 24

Carbohydrate-Base Motor Fuels. *By Alex Taub* 28

Airbriefs 31

Some B-29 Design Features 32

New Production Equipment 35

A Modern Application of Cost and Budgetary Controls. *By P. B. Crouse* 36

Truck Problems Analyzed at SAE National T & M Meeting 44

News of the Industry 46

Calendar of Coming Events 56

New Products for Aircraft 60

New Products 74

Advertisers Index 230

Copyright 1944 by Chilton Company (Inc.)

Automotive Division

Jos. S. HILDRETH, President and Manager

JULIAN CHASE, Vice Pres. G. C. BUZBY, Vice Pres.

OFFICES

Philadelphia 39, Pa., Chestnut & 56th Sts., Phone Sherwood 1424
New York 17, N. Y., 100 East 42nd St., Phone Murray Hill 5-8600;
Chicago 1, Ill., Room 916 London Guarantee & Accident Building, Phone Franklin 4243; Detroit 2, Mich., 1015 Stephenson Bldg., Phone Madison 2090; Cleveland 14, Ohio, 609 Guardian Bldg., Phone Cherry 4183; Washington 4, D. C., 1061 National Press Bldg., Phone District 8109 and 8110;
San Francisco 5, Calif., 605 Market St., Room 708, Phone Douglas 0967;
Los Angeles 1, Calif., 6000 Miramonte Blvd., Phone Lafayette 5525.

Cable Address ..... Autoland, Philadelphia

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by

CHILTON COMPANY

(Incorporated)

Executive Offices

Chestnut and 56th Streets, Philadelphia 39, Pa., U. S. A.

Officers and Directors

C. A. MUSSELMAN, President

Vice-Presidents

JOS. S. HILDRETH — GEORGE H. GRIFFITHS
EVERIT B. TERHUNE — J. H. VAN DEVENTER — C. S. BAUR
WILLIAM A. BARBER, *Treasurer* — JOHN BLAIR MOFFETT, *Secretary*
JULIAN CHASE — THOMAS L. KANE — G. C. BUZBY
P. M. FAHRENDORF — HARRY V. DUFFY — CHARLES J. HEALE

Use Ahlberg in your planning. A competent engineering service is at your command. Ahlberg engineers are close students of product trends. They are helping now to create new products, and new designs—are helping industry get ready for the world's vast conversion back to peace-time production.

This kind of thinking is as intensely interesting as it is thoroughly practical. Ahlberg's experience and facilities are available to you—a letter makes the contact.

Ahlberg Engineering Counsel is available at 24 factory branches.

AHLBERG BEARING COMPANY

3002 W. 47th St. Chicago, Ill.

CJB BALL BEARINGS

AUTOMOTIVE *and* AVIATION INDUSTRIES. Vol. 91, No. 2. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $1.00 per year. Canadian and Foreign $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

A Model MCY, Double Compression G-H Baler — one of several installed in various plants of a large industrial concern. Arrow indicates location of loading hopper which facilitates loading loose scrap while press finishes the bale.

★

Is Sheet Metal Scrap a *Bottleneck* in Your Plant?

In many plants, high production quotas . . . resulting in abnormal accumulations of sheet-metal scrap . . . have demonstrated the need for an orderly system of scrap-metal salvage and disposal. Wherever sheet metal is fabricated in volume, an efficient baling press of adequate size and capacity is the "heart" of the scrap salvage program.

Galland-Henning Hydraulic Baling Presses are built in a wide range of styles and sizes . . . and in capacities from ¼ ton to 20 tons per hour . . . to meet every industrial requirement for the baling of ferrous and non-ferrous sheet metal scrap. Don't let the accumulation of sheet metal scrap become a production "bottleneck" or safety hazard in *your* plant. For experienced counsel on the efficient, orderly salvaging of sheet metal scrap, write

GALLAND-HENNING MFG. CO.
2774 SOUTH 31st STREET MILWAUKEE 7, WISCONSIN

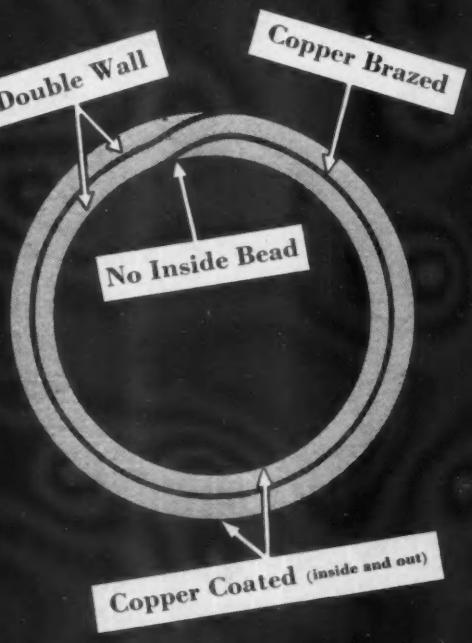
GALLAND-HENNING

SCRAP METAL BALING PRESSES

A 4454-1P

Bundyweld Steel Tubing

Its solid double wall construction meets all tests for superior performance



Investigate Bundyweld for your tubing requirements

Bundyweld Steel Tubing is laterally rolled twice around from a single strip of copper-coated S.A.E. 1010 steel. The rolled tube is then passed through a brazing furnace from which it emerges as a solid, double-wall steel tube completely copper-brazed throughout the entire 360° of wall contact.

The Bundy double flare, illustrated at the right, assures leak-proof, pressure-proof joints, and safely permits frequent removal and replacement of fittings as well as over-torqueing.

Bundyweld is furnished hard or annealed in a wide range of standard diameters and gauges up to 5/8" O.D. Special sizes, cold drawn as desired. Also furnished in Monel.

Bundy Research Engineers will be glad to assist with either your war or peacetime tubing problems. Bundy Tubing Co., Detroit 13, Mich.

Bundy Double Flare

Operation No. 1

Operation No. 2

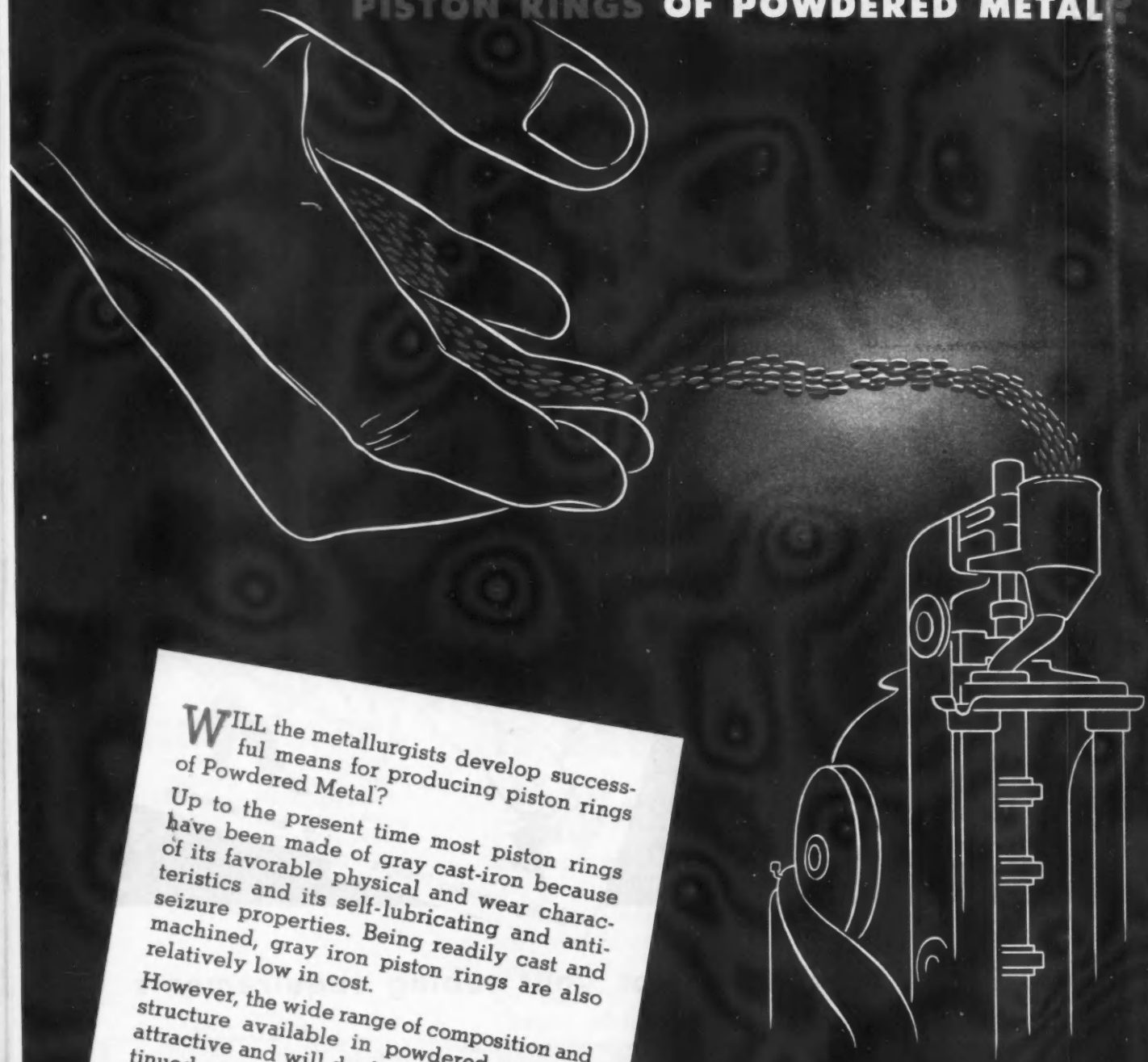
BUNDY TUBING

ENGINEERED TO YOUR EXPECTATIONS

BUNDY TUBING DISTRIBUTORS:

Pacific Metals Company, Ltd. 3100 19th Street San Francisco 10, California	Standard Tube Sales Corp. 1 Admiral Avenue Maspeth, New York City, N. Y.	Lapham-Hickey Company 3333 W. 47th Place Chicago 32, Illinois	Rutan & Company 112 South 16th Street Philadelphia 2, Pennsylvania	Eagle Metals Company 3628 East Marginal Way Seattle 4, Washington

PISTON RINGS OF POWDERED METAL?



WILL the metallurgists develop successful means for producing piston rings of Powdered Metal?

Up to the present time most piston rings have been made of gray cast-iron because of its favorable physical and wear characteristics and its self-lubricating and anti-seizure properties. Being readily cast and machined, gray iron piston rings are also relatively low in cost.

However, the wide range of composition and structure available in powdered metal is attractive and will doubtless stimulate continued piston ring research in this rapidly growing technique.

Whatever the material or the method of manufacture you will find Muskegon engineers and metallurgists equipped with the broadest production experience. Consult them on any piston ring problem.

DOUBLE War Bond Purchases NOW!

MUSKEGON
Piston Rings

MUSKEGON PISTON RING CO.
MUSKEGON, MICHIGAN
PLANTS AT MUSKEGON AND SPARTA

The Tractor that Brushes off a Jungle!

WHEN THE MARINES LAND... so do the Seabees armed with tractor bulldozers, *their favorite combat weapon*. To clear beach-heads for attack troops. To carve air-strips out of jungles. To lay roads over mountains. To drain swamps and build bridges. Yes, *sometimes even to fight!*

Like that time during a South Pacific landing... when strong Jap machine-gun fire held back everything except one man with a bulldozer, who charged in and with one sweep of the blade, cleaned out the nest and buried a dozen Japs.

Of such stuff are Seabees and their bulldozers made. And, like the men who man them, these blade-wielding tractors are built to "take it," where the going is tough. "Take it" they do, too, when they crack into rocks, butt into trees, bite into dirt, dive under water into mud and sand... or head into enemy fire.

Helping them stand up under the punishing shocks of load and impact are the husky, smooth rolling Hyatt bearings into which we build great stamina and capacity while holding them true to required precision tolerances.

Hyatts are liberally used to protect the vital operating parts of these ponderous machines of modern war. Tomorrow, these same high quality bearings will help you build better machines and hold competitive advantages in the post-war markets.

HYATT BEARINGS

DIVISION OF

GENERAL MOTORS

HARRISON, N. J.

TRY "ENGINEERED" LOCKING!

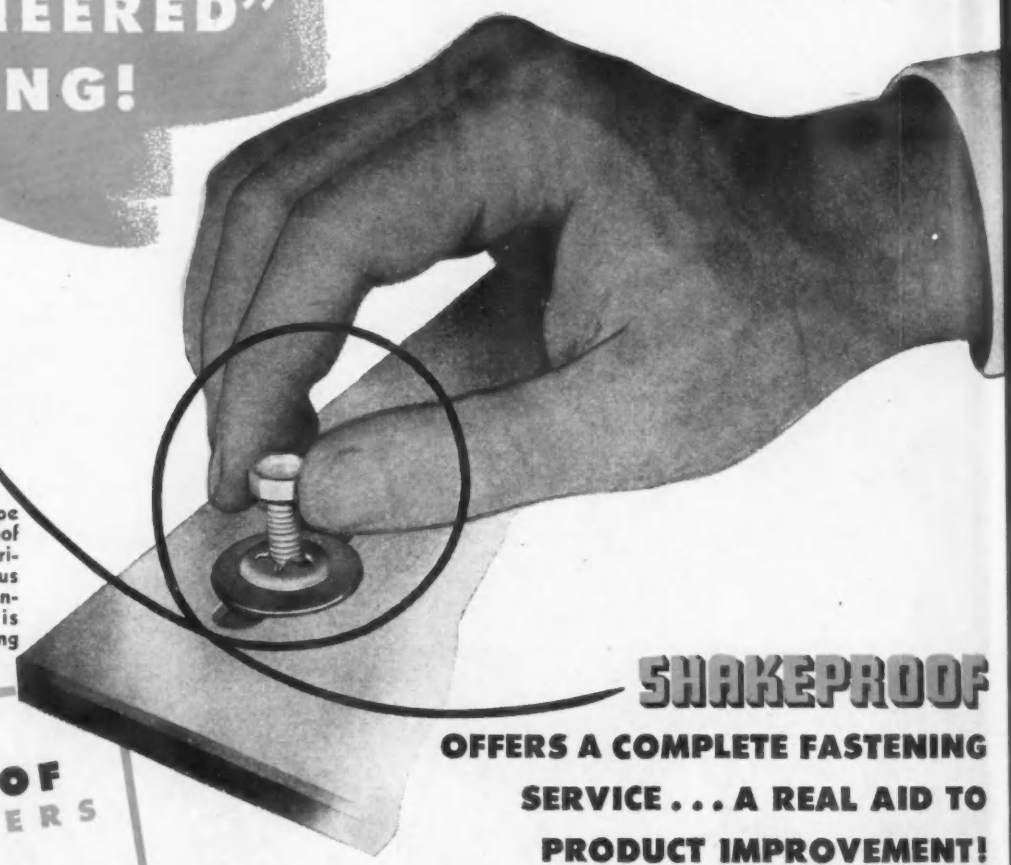


Illustration showing Shakeproof Type 45 Dome Lock Washer. Shakeproof Dome Lock Washers with plain periphery are particularly advantageous when used to span oversize or elongated clearance holds. Pressure is directed to the outer rim, distributing the load over a large area.

SHAKEPROOF LOCK WASHERS

TYPE 11 EXTERNAL TOOTH
For U. S. Standard Hex Nuts; Square Nuts; Hex Washer Head Screws; Binding Head Screws; Truss Head Screws.

TYPE 12 INTERNAL TOOTH
For S.A.E. Hexagon Nuts; Round Head Screws; Fillister Head Screws; Hexagon Head Screws.

TYPE 15 COUNTERSUNK TOOTH
For Flat Head Screws; Oval Head Screws.

TYPE 40 EXTERNAL-INTERNAL TOOTH
For Electrical Bonding Applications.

WRITE FOR FREE TEST KIT No. 21

SHAKEPROOF OFFERS A COMPLETE FASTENING SERVICE . . . A REAL AID TO PRODUCT IMPROVEMENT!

Modern fastening techniques, such as those developed and recommended by Shakeproof Engineers, have led to the improved utility of countless products. These engineers, with their thorough knowledge of fastenings and the materials with which they are used, are well qualified to help you in obtaining the most efficient locking for your particular applications. Shakeproof offers you this service in the interest of product improvement—without obligation.

There's a "plus" value to the Shakeproof service . . . providing you with the choice of six standard lock washer styles . . . all incorporating the exclusive Shakeproof tapered-twisted tooth locking principle. Such a combination assures locked-tight, vibration-resisting efficiency. Call in a Shakeproof engineer—let him analyze your products and show you how these fastenings will help give them a longer life and more satisfactory performance. Write today!

SHAKEPROOF inc.

Fastening Headquarters

Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
2501 North Keeler Avenue, Chicago 39, Illinois
Plants at Chicago and Elgin, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

Shakeproof Type 1 Thread-Cutting Screws for Metals

Shakeproof Type 25 Thread-Cutting Screws for Plastics

Sems Fastener Units Pre-Assembled Shakeproof Lock Washer and Screw

Shakeproof Cowl Fasteners . . . "The Quick-Opening Lock"

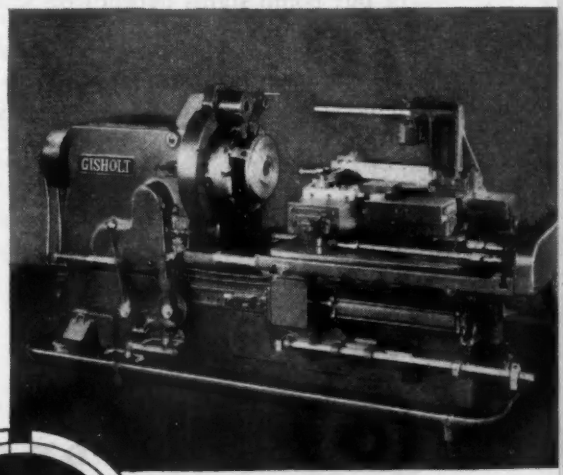
. . . BY THE GISHOLT SIMPLIMATIC

Production cost on one lot cut from $74 to $21.50!

"Thanks to Gisholt Simplimatics," said the manufacturer who reported this impressive saving. On switching to Simplimatic Lathes, he saw the output jump almost 50% . . . costs cut 71%! And the four Simplimatics required only *two* operators where the previous machines took *four!*

Results like this are to be expected where Simplimatics take over. For these rugged, multiple-cutting lathes are designed to provide the extremely high speed so vital to mass production. Since all operations are completely automatic, one operator can tend several machines.

There you have it—high speed, extreme accuracy, simple operation. If these things are important to you, investigate the Gisholt Simplimatic now. A postcard will bring full particulars.



GISHOLT MACHINE COMPANY
1205 East Washington Ave. • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . with Gisholt Improvements in Metal Turning

GISHOLT SIMPLIMATICS are built in both Platen and Radial types. Both permit a wide variety of tool arrangements, yet neither requires a high degree of skill from the operator.

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

For Hitting the "Pinpoint" from Five Miles Upstairs

Microhoning Provides Vital

High altitude bomb sights need a certain number of bearing surfaces of almost perfect precision accuracy and surface finish. The amazing accuracy of our bomb sights depends on this near-perfect accomplishment.

The thousands of these bomb sights needed made it necessary to achieve this fine instrument precision at production speed.

Ordinary machining practice can't produce such results—and fine instrument methods just aren't fast enough.

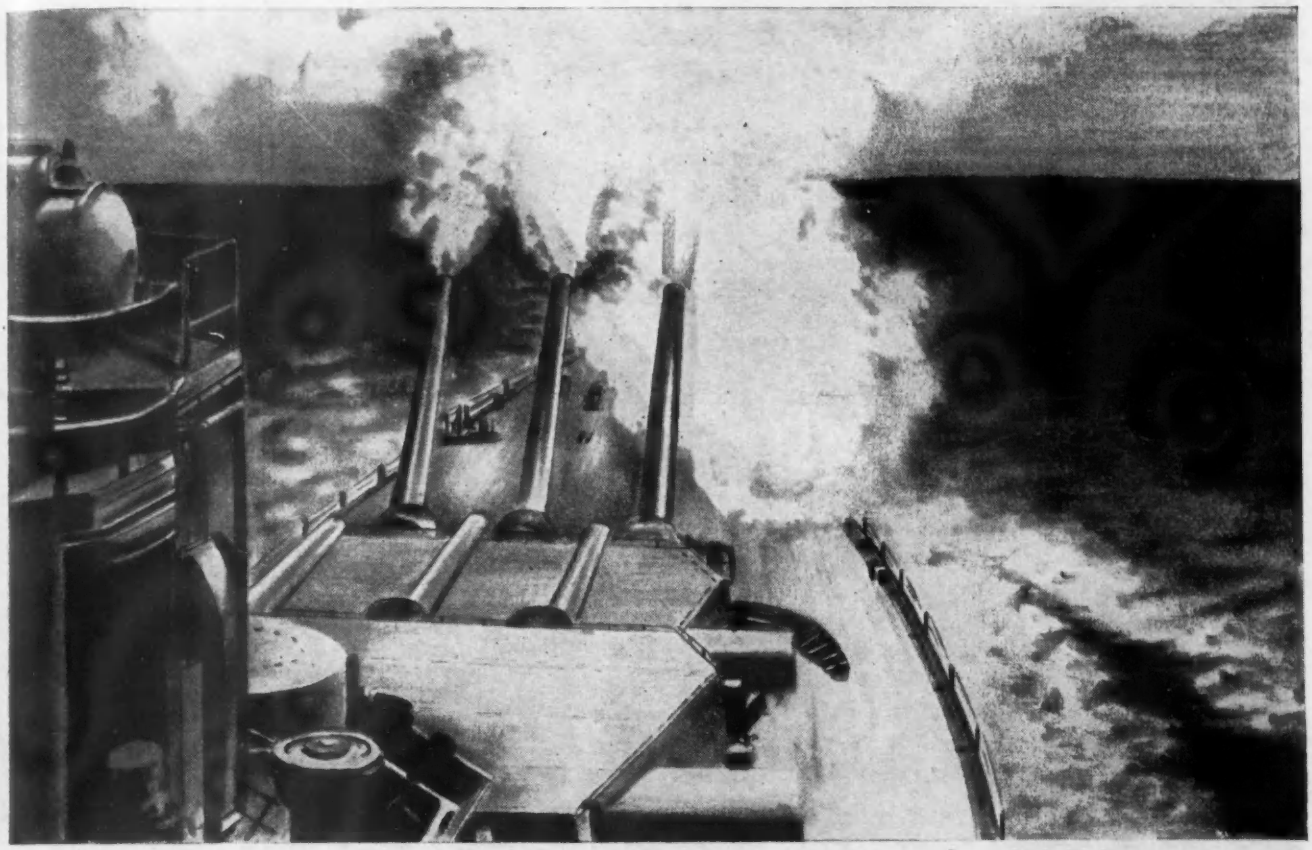
Microhoning bridged the gap. By means of this highly controlled abrading process, the extreme precision needed was obtained at production rates.

This modern final machining process will generate dimensional accuracy to "tenths" and fractions of "tenths", and provide any desired surface finish. It is applicable to the bores of these bomb sight bearings as it is to highly loaded gun turret bearings.

Precision Microfinish Honing will make many important contributions in postwar processing and Micromatic engineers will be ready with many new honing developments.

MICROMATIC
HONE CORPORATION
DETROIT 4, MICHIGAN

MAKERS OF HONING MACHINE TOOLS



. . . or Blasting a "Tin Can" Beyond The Horizon

Precision Bearings in Wartime Production

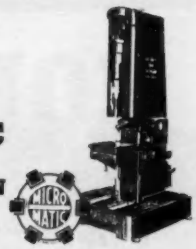
A battleship gun turret is a complex precision instrument on a gigantic scale. Each complete turret weighs about 1550 tons—as much as an entire medium weight destroyer. This great mass must not only move smoothly, but also very rapidly—guns must be quickly targeted with extreme precision and without backlash. That calls for something extraordinary in the way of bearings.

They must be dependable and have amazing accuracy. Inaccuracy or the slightest imperfection of operating fit would destroy the telescope precision needed to make each shot count.

The best ordinary machining methods won't provide the precision nor the fine surface finish necessary for accurate frictionless operation.

Microhoning was found to be the answer. Microhoning is a process of final machining which generates average bore accuracy for roundness and straightness within .0002" to .0003"—which removes up to 65 cubic inches of stock per hour. In production of turret bearings—not only for battleships, but also for cruisers and destroyers—Microhoning has provided the desired combined precision and finish.

And, it will be more constructively useful in coming times of peace than it has been in war production.



MICROMATIC
HONE CORPORATION
DETROIT 4, MICHIGAN

MAKERS OF HONING MACHINE TOOLS

Economy Benefits from

NOX-RUST NO. 310-AC

The Master Rust Preventive

Users say **NOX-RUST No. 310-AC** is the most economical and effective for these purposes:

1 REMOVES CONTAMINANTS, such as fingerprints, water and other rust-creating foreign matter from metal surfaces.

2 PREVENTS RUST between machine operations. Since NOX-RUST No. 310-AC actually displaces water from metal surfaces it guards against the rust that forms when metals "sweat" due to temperature changes.

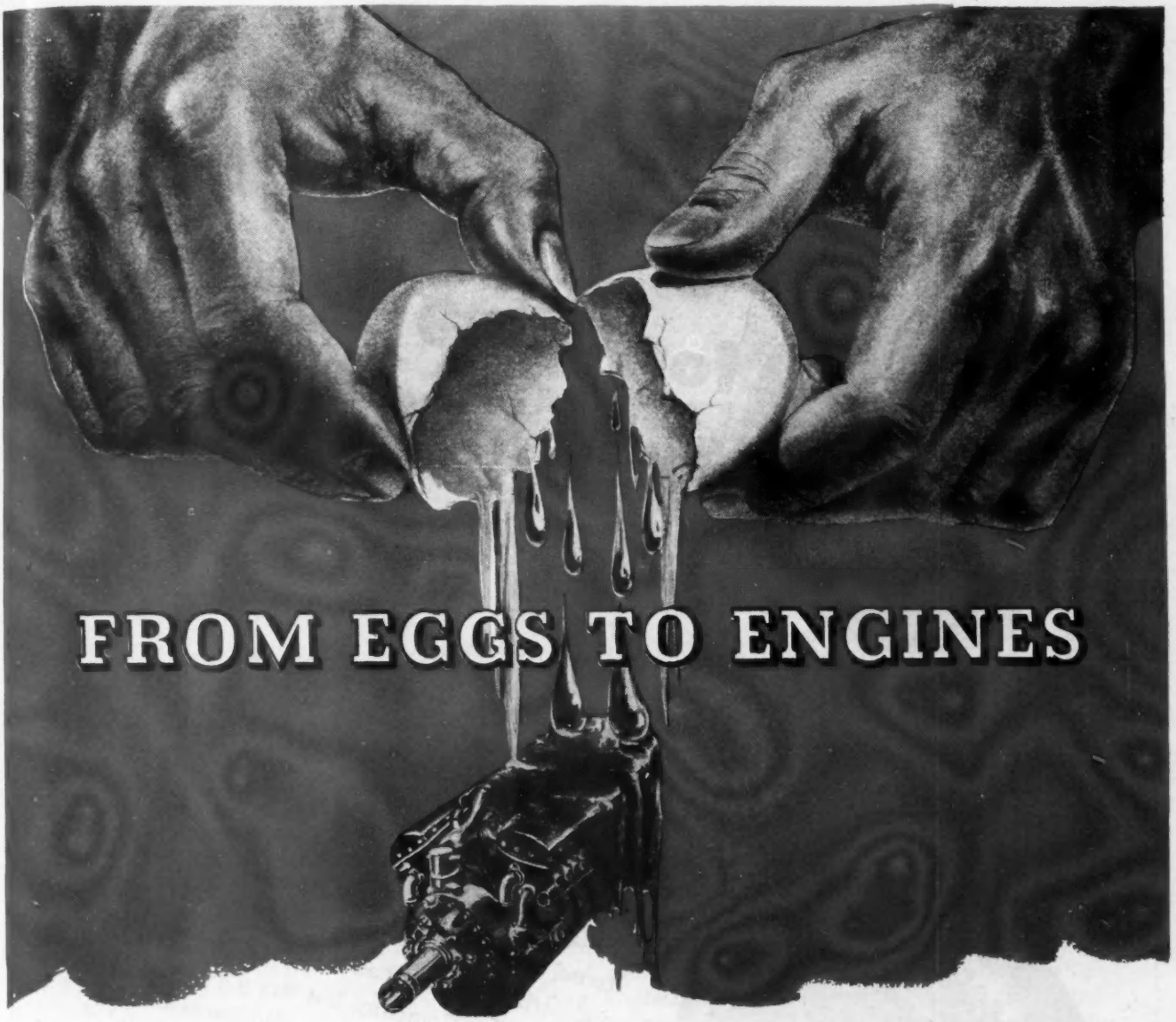
The dual protection afforded by NOX-RUST No. 310-AC is particularly valuable for intra-plant work. Rust may show up on work left just overnight or stock in storage over a long period of time. Not, however, if it is protected with NOX-RUST No. 310-AC. A trial in your own plant will convince you of the value of NOX-RUST No. 310-AC for the protection of your production.

Write Today for Technical Bulletin

NOX-RUST CORPORATION

2433 S. HALSTED ST. CHICAGO 8, ILL.

BRANCH OFFICES • BUFFALO • DETROIT • LOS ANGELES



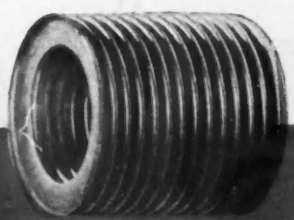
AUTOMATIC TEMPERATURE and pressure-control devices are vital to daily life as we are rapidly growing to know it.

They guard the healthful freshness of the eggs in our refrigerators, the efficiency of our automobile and airplane engines, and even the huge Diesels that propel some of our ships.

They have become vital parts of almost everything that moves, gets hot or cold or just stays at the same temperature.

Sylphon Bellows are as vital to temperature and pressure-control instruments as these devices are to daily life, and design engineers during the past 40 years have learned that when the problem involves temperature, pressure, sealing, expansion or the handling of gases or liquids —there is a Fulton Sylphon design that literally grows into the plans.

Take advantage of Fulton Sylphon's exhaustive design files. Send for Bulletin OB-20.

FULTON  **SYLPHON**

TEMPERATURE CONTROLS — BELLOWS . . . BELLOWS ASSEMBLIES

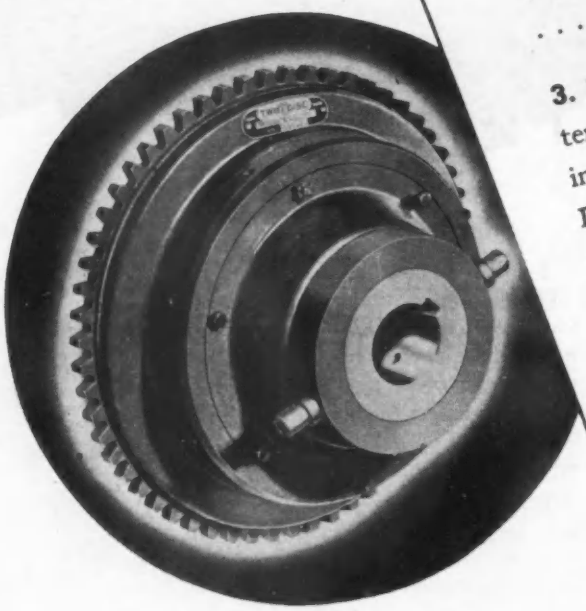
THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Brothers, Montreal

3 REASONS for Using Standard Twin Disc Clutches!

1. By specializing in clutch manufacture the clutch specialist is able to combine the economies of volume production with the maximum in performance and wear-life qualities.

2. By eliminating the use of "Specials" you assure complete replacement parts stocks with a moderate investment. Thus the clutch specialist is prepared to give you the best of service . . . supply needed parts at moderate prices.



3. By working closely with the designer of internal combustion engines and various types of industrial machinery and equipment, the Twin Disc Clutch Company has developed a complete line of friction clutches which meets every need. Their record of performance in the industrial fields is your assurance of uniformity and adequate wear-life.

That's why, in the designing of a new piece of equipment, you'll find it to your advantage to use *Standard* Twin Disc Clutches. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 91 July 15, 1944 Number 2

Net Sales—$7 Billions in 1943 17

The automotive industry has gone out and again accomplished great things. In the war effort it stands out in a position all its own. In this article the facts and figures bring out what a really big job it has done.

Ex-Cell-O Production 20

Fuel injections systems for Diesel powered war machines have been the principal interest of this organization. They have been turned out in really large quantities. How this task has been accomplished is told here. The text is liberally illustrated.

Reserves Ensure America's Gasoline Supply 24

In the previous issue of AUTOMOTIVE AND AVIATION INDUSTRIES the author discussed "Our Crude Oil Outlook" with a thoroughness that could only have been done after a great deal of study and research. In this issue he carries on into the reserves that are tied up in natural gas, coal and shale oil.

Design Features of the B-29 32

This big superfortress has been giving a most remarkable account of itself on the war fronts. Here are explained and shown some of the things that make it really great.

Cost and Budgetary Controls 36

Making the dollar do its full job on the production line is something that has been accomplished at the Consolidated Vultee Aircraft Corp. They have a system. In this article it is explained with thoroughness. Forms are shown and the reader is told how they are used. It is highly informative.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Liberty and Freedom

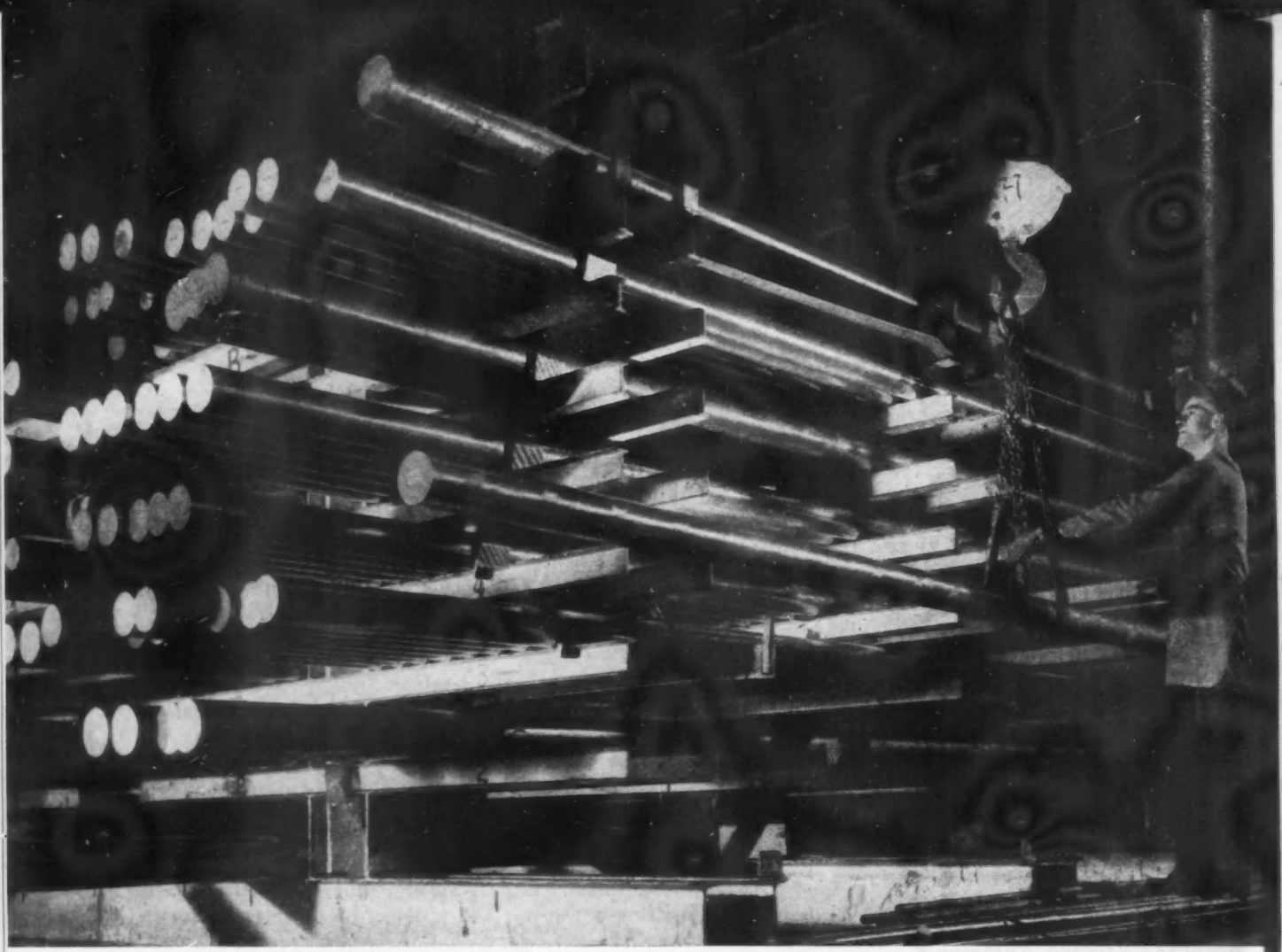
By Julian Chase

THERE have been times in America when, with rare exceptions, it was only in the season of Independence Day that the words Liberty and Freedom were moved into the active part of the average American's vocabulary. During those long, matter-of-fact periods it was almost solely on or about the Fourth of July or some similar occasion that the special significance of these words with respect to him and his daily activities was developed into the soul satisfying thoughts which naturally grow from a realization of the conditions which they describe. But that is not true today.

Today we hear and read these two words often. They travel through the air on many wave lengths. They are sprinkled over our printed pages. They ring out from rostrums. They color the conversation of the average man. And that is so not merely because we are fighting a war for the freedom of other peoples. It is so not because we ourselves have more liberty and freedom than we ever had before. It is so, chiefly, because we have less. It is so because of widespread and well founded belief that the government which our forefathers established to safeguard our liberties has progressively and drastically restricted them. We hear and read these words today most frequently in vigorous protest against abridgement and in fervent proclamation of our inalienable rights.

As has been truly said, liberty is not something that early discoverers found in America like Indian corn, tobacco and the wild potato. Its seed came here as an inherent hope in the heart of man. That seed was planted and nurtured and it grew. The growing plant was carefully guarded, sometimes with misguided fanatical zeal. But it developed and spread with a broader understanding of what real liberty is. And in the course of time a structure was designed with a view to protecting it forever and for the benefit of all. That structure was the Constitution of the United States.

But, as we now know well, liberty is something that is never finally won or held without ceaseless struggle. "The history of liberty," said Woodrow Wilson, "is a history of resistance . . . a history of *limitation of governmental power* not the increase of it." True Americans are today determined to return to liberal government by law from increasingly restrictive government by whim.



STEEL—*Quick Shipment*

JOSEPH T. RYERSON & SON, INC.

CHICAGO.....16th and Rockwell Sts.
Rockwell 2121
MILWAUKEE.....320 So. 19th St.
Mitchell 7000
DETROIT.....1600 E. Euclid Ave.
Madison 3860
ST. LOUIS.....5 Clinton St.
Central 1020
CINCINNATI..Front St. and Freeman Ave.
Cherry 3232
CLEVELAND....E. 53rd and Lakeside Ave.
Henderson 1000
PITTSBURGH.....330 Grant St.
Walnut 7540; Carnegie 795
PHILADELPHIA.....5200 Grays Ave.
Bell-Belgrade 1412; Keystone-West 1644
BUFFALO.....40 Stanley St.
Humboldt 3311
NEW YORK.....203 Westside Ave.
Jersey City, N. J.
New York City.....Rector 2-3700
Newark.....Market 2-6067
Jersey City.....Bergen 4-1123
BOSTON..Third & Binney Sts., Cambridge
Kirkland 6000

CALL THE PLANT NEAREST YOU

From 11 Convenient Ryerson Plants

Your nearby Ryerson plant carries a large stock of practically every kind of steel you need. All the various shapes and sizes—hot rolled, cold finished and heat treated—in carbon, alloy, stainless and tool steel grades, are ready for immediate shipment. Special steels—free-machining, forging, heat treating or for other processing—are also included. All Ryerson alloy steels are identified with heat symbols stamped or tagged on the bars. Complete test data on analysis, hardenability response and obtainable physical properties for 1, 2, 3 and 4 inch rounds quenched and drawn at 1000°, 1100° and 1200° F., is furnished with each alloy shipment.

If you are faced with the possibility of cutbacks or contract terminations, we suggest that you keep your own steel inventory at a practical working level and avoid the risk of loss. Rely on Ryerson to supplement your stocks. Whenever you need steel, call Ryerson for quick action.

BUY U. S. WAR BONDS

RYERSON

AUTOMOTIVE and AVIATION INDUSTRIES

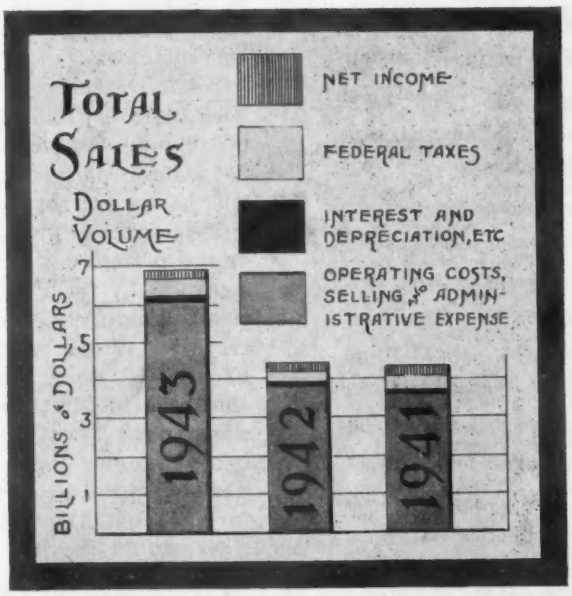
Published on the 1st and 15th of the month

July 15, 1944
Vol. 91, No. 2

Net Sales *of 16 Motor Vehicle Companies at New High—* $7 Billions in 1943

By Marcus Ainsworth

SIXTEEN motor vehicle manufacturers produced materials for war during 1943 of which the net sales value amounted to $6,907,497,000 or nearly 2.5 billions more than the corresponding value of goods produced by the same manufacturers during 1942. In net sales value, the 1943 output constituted a 57 per cent increase over 1941, the peak year, in which peacetime sales amounted to $4,392,179,000. These net sales figures are exclusive of those of the Ford Motor Co. which does not report its sales or earnings. Expressing 1943 net sales in terms of motor vehicle production by accepting the 1941 average wholesale value per vehicle as a standard, the somewhat controversial conclusion is reached that the motor vehicle industry, exclusive of Ford, was producing at the rate of approximately 9,000,000 vehicles per year during 1943. During 1941, the domestic unit sales of these 16 motor vehicle manufacturers, as shown by new motor vehicle registrations, amounted to approximately 99.5 per cent of total domestic sales for all companies except the Ford Motor Company.



This chart is a graphic presentation showing the distribution of the various components of the total net sales dollar volume of 16 motor vehicle manufacturers. Data secured from consolidated income statements of the companies.

Out of this $6,907,497,000 in net sales in 1943, these motor vehicle manufacturers contributed $449,867,000 to the Federal treasury in the form of income and excess profits taxes. This was an increase of 88 per cent over the amount paid out in Federal taxes during 1942, when $239,208,000 was taken out of earnings before taxes. In addition to these Federal taxes, large tax payments were made to state and local governments.

While net sales and Federal taxes have been increasing, net income after all charges has been steadily decreasing. During 1941, the last year of peacetime production, net income amounted to $296,892,000. During the first year of the war, the net income decreased to $232,179,000 and for 1943 there was an additional drop to $228,140,000. This decline can largely be attributed to the steadily increasing Federal tax rates and the mounting costs of operations, the greatest factor of which is labor costs.

This drop in net income during the three years 1941, 1942 and 1943, is reflected in the amount of

Table I

(Thousands of Dollars)

	1943	1942	1941
Capital Stock & Capital Surplus	$1,147,794	$1,118,427	$1,118,468
Earned Surplus	958,984	868,440	768,861
Total Net Worth	$2,106,778	$1,986,867	$1,887,329
Net Income as per cent of Net Worth	11.4%	11.7%	15.7%

dividends paid out. Stockholders received $222,969,000 during 1941, $135,988,000 in 1942 and $134,487,000 during 1943. For every dollar of net sales during 1943 only 1.9 cents was paid out in dividends, while in 1942 it was 3.07 cents and in 1941, 5.08 cents. Fifty-nine cents of every net income dollar during 1943 was used to pay dividends. The remaining 41 cents stayed in the business in the form of increased assets. In 1942 dividends amounted to approximately the same proportion of the net income dollar as in 1943, but for 1941 75 per cent of the net income dollar was used for that purpose.

Even though net income and dividends have declined for two years while volume of sales has materially increased, the return on the investment or net worth of these 16 companies consolidated has maintained a fairly good position, as illustrated in Table I.

A glance at Table II (on facing page) which shows a breakdown of the financial statements of these 16 motor vehicle manufacturers for selected items indicates that the ratio of current assets to current liabilities has been maintained according to recognized credit ratio of 2 to 1. Actually, ratios of current assets to liabilities were 1.98, 2.02 and 2.28 to 1 respectively for the years 1943, 1942 and 1941. This table also shows that total current assets for all companies increased 22 per cent during 1943 over 1942 and 65.8 per cent over 1941, but at the same time current liabilities moved upward 24 per cent and 90 per cent.

The cash position of these 16 vehicle manufacturers materially improved during 1943 with respect to that of 1942. Cash and securities totaled $1,064,384,000 for 1943 as compared with $707,343,000 for 1942, an increase of $357,041,000 or 50.5 per cent; 1942 showed a decrease from 1941 of about 4½ per cent, due no doubt to the conversion to wartime manufacture.

Even though the dollar volume of inventories for 1943 shows a marked increase over that of 1942, the position of the 16 motor vehicle manufacturers has improved slightly in this respect. In relation to current assets, inventories declined from 34.7 per cent of current assets during 1942 to 33.4 per cent for 1943. During 1941 inventories were 36.6 per cent of current assets.

While reserves (exclusive of depreciation) have been built up from $202,460,000 in 1942 to $268,087,000 during 1943, an increase of approximately $66,000,000 or 33 per cent, only time will tell as to whether or not these will be adequate for postwar requirements. A great deal will depend upon whether or not prompt settlement is made for all outstanding contracts by the Federal government upon the cessation of hostilities, and the length of time required to reconvert from wartime to peacetime production. From 1941, when reserves (other than depreciation) amounted to $180,873,000, to 1942, the increase was slightly over twenty-one-and-a-half million dollars In relation to net sales, reserves have declined. They were 3.9 per cent of net sales for 1943, 4.6 per cent for 1942 and 4.1 per cent of net sales during 1941.

Nearly $94 million remained after dividends were paid out of net income. These $94 million were reinvested in the busines and the manner in which it was distributed will be found in Table III.

A statistical summary of the salient features of this financial analysis will be found in Table IV.

Table III

1943 Reinvested Earnings

Net Income	$228,140,000
Less dividends paid out	—134,487,000
Reinvested in business	$93,653,000
Reflected as follows:	
Increase in Current Assets	+533,322,000
Decrease in Non-Current Assets	—54,174,000
Increase in Current Liabilities	—293,439,000
Increase in Reserves	—65,627,000
Increase in Other Liabilities	—171,000
Increase in Capital Stock and Capital Surplus	—29,367,000
	$90,544,000
Earned Surplus Special Adjustment	+3,109,000
Reinvested in business	$93,653,000

Table IV

Statistical Summary of the Financial Analyses of Sixteen Motor Vehicle Manufacturers.

1. Net Sales during 1943 increased 56% over 1942 and 57% over 1941.
2. Income and Profits Taxes during 1943 increased 88% over 1942 and 18% over 1941.
3. Net Income during 1943 decreased 1.6% from 1942 and 23% from 1941.
4. Dividends during 1943 decreased 1% from 1942 and 39.6% from 1941.
5. Cash and Securities during 1943 increased 50.5% over 1942 and 45.5% over 1941.
6. Inventories during 1943 increased 17.5% over 1942 and 51.7% over 1941.
7. Accounts Receivable during 1943 increased 3.8% over 1942 and 134% over 1941.
8. Current Assets during 1943 increased 22.0% over 1942 and 65.8% over 1941.
9. Current Liabilities during 1943 increased 24% over 1942 and 90% over 1941.
10. Reserves during 1943 increased 32.8% over 1942 and 48.3% over 1941.
11. Earned Surplus during 1943 increased 10.6% over 1942 and 25.0% over 1941.
12. Dividends were 1.9% of sales during 1943, 3.07% of sales during 1942 and 5.08% during 1941.
13. Net income was 3.3% of sales during 1943, 5.2% of sales during 1942 and 6.8% during 1941.
14. Reserves amounted to 3.9% of sales during 1943, 4.6% of sales during 1942 and 4.1% during 1941.
15. Earned Surplus was 13.9% of sales during 1943, 19.6% of sales during 1942 and 17.5% during 1941.
16. Ratio of Current Assets to Current Liabilities in 1943 was 1.98 to 1; 2.02 to 1 in 1942 and 2.28 to 1 in 1941.
17. Per cent Inventories of Current Assets in 1943 was 33.4%, 34.7% in 1942 and 36.6% during 1941.
18. Per cent Cash and Securities of Current Assets in 1943 was 35.6%, 28.8% in 1942, 40.5% during 1941.

Table II. Financial Analyses of 16 Motor Vehicle Manufacturers, 1941-1942 and 1943

(Thousands of Dollars)

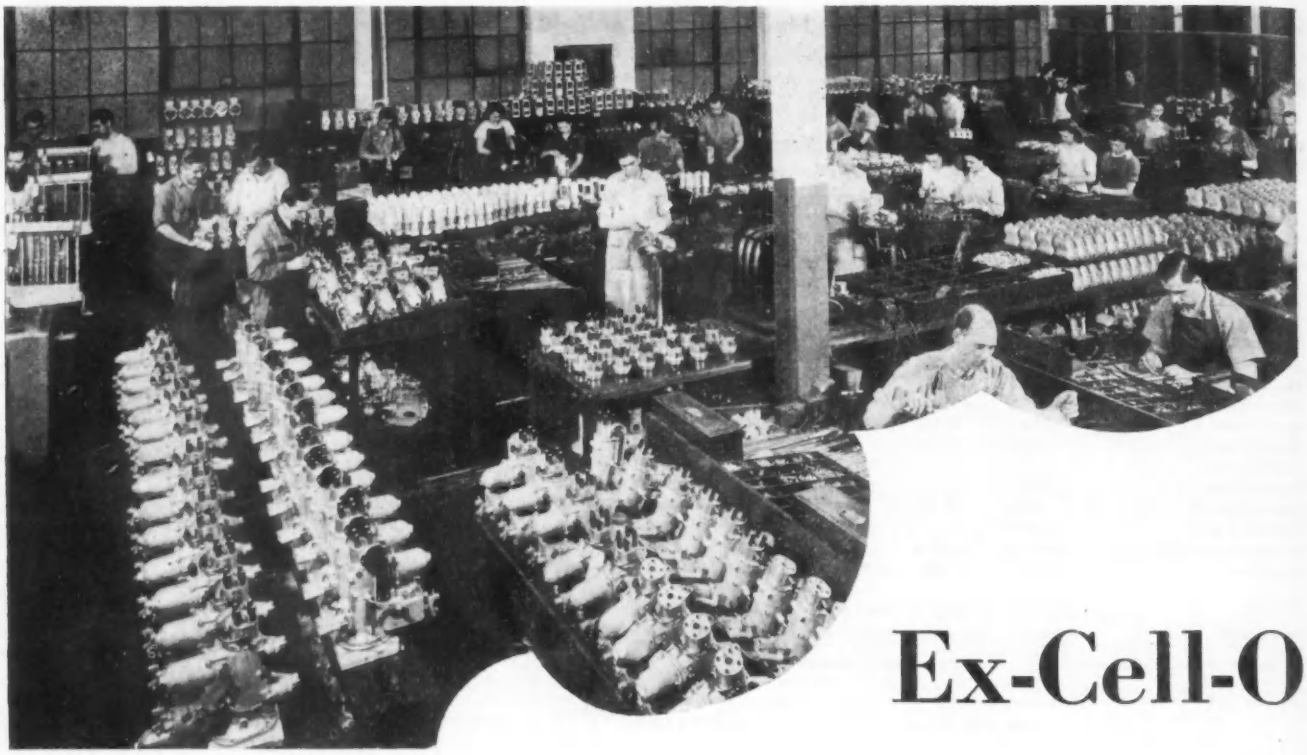
	NET SALES			INCOME AND EXCESS PROFITS TAXES			NET INCOME AFTER TAXES			DIVIDENDS		
	1943	1942	1941	1943	1942	1941	1943	1942	1941	1943	1942	1941
Chrysler Corp.	$886,468	$623,655	$888,366	$33,750	$22,000	$28,660	$23,323	$15,529	$40,114	$13,053	$15,229	$26,107
General Motors Corp.	3,796,116	2,250,549	2,436,801	266,508	96,969	287,992	149,780	163,652	201,653	96,285	96,171	171,787
Total	$4,682,584	$2,874,204	$3,325,167	$300,258	$120,969	$316,652	$173,103	$179,181	$241,767	$109,338	$111,400	$197,894
Autocar Co.	85,801	63,392	31,932	10,389	8,422	1,709	1,971	1,552	1,493	711	925	27
Brockway Motor Co.	12,134	8,500	9,426	1,420	850	439	363	319	528	216	160	159
Diamond T Motor Car Co.	123,827	98,720	44,698	7,330	7,744	2,727	2,517	2,044	1,365	527	421	632
Federal Motor Truck Co.	25,789	27,015	10,652	2,062	1,760	90	655	537	820	197	197	49
Hudson Motor Car Co.	154,947	106,667	66,827	2,165	911	84	1,638	2,122	3,756	318	.....	.....
International Harvester Co.†	448,035	364,527	364,635	25,870	31,130	26,421	25,693	26,747	30,635	16,330	16,330	16,877
Mack Trucks, Inc.	124,681	97,298	76,560	12,000	14,040	5,500	3,073	2,988	2,944	1,792	1,792	1,792
Marmon-Herrington Co., Inc.	29,201	28,694	9,567	2,088	7,302	1,651	1,162	1,316	616	.....	337	187
Nash-Kelvinator Corp.‡	184,936	82,061	122,045	6,802	3,605	3,525	4,116	3,829	4,617	2,146	2,146	1,072
Packard Motor Car Co.	340,717	221,922	115,319	22,540	10,430	1,619	4,755	4,726	2,061	1,499	1,499	1,499
Sterling Motor Truck Co.*	6,458	6,928	5,095	678	600	200	158	316	241	56	.....	.....
Studebaker Corp.	364,191	221,421	115,700	14,200	5,800	3,475	2,835	2,048	2,486	576	.....	.....
Willys-Overland Motors, Inc.	167,756	109,274	21,781	22,185	6,880	.....	3,011	1,265	809	.....	.....	.....
White Motor Co.	156,440	121,902	72,775	19,880	18,765	4,350	3,090	3,189	2,754	781	781	781
Total	$2,224,913	$1,558,321	$1,067,012	$149,609	$118,239	$64,411	$55,037	$52,998	$55,125	$25,149	$24,588	$25,075
Grand Total	$6,907,497	$4,432,525	$4,392,179	$449,867	$239,208	$381,063	$228,140	$232,179	$296,892	$134,487	$135,988	$222,969

†—For years ending October 31st. ‡—For years ending September 30th.

	CASH AND SECURITIES			INVENTORIES			ACCOUNTS RECEIVABLE			CURRENT ASSETS		
	1943	1942	1941	1943	1942	1941	1943	1942	1941	1943	1942	1941
Chrysler Corp.	$130,114	$87,522	$69,771	$139,864*	$112,151*	$77,986	$85,442	$59,914	$7,737	$357,152	$259,588	$186,652
General Motors Corp.	554,431	344,746	481,312	564,411	466,266	332,827	525,114	502,839	183,477	1,643,956	1,313,850	997,616
Total	$684,545	$432,268	$551,083	$704,275	$578,417	$410,813	$610,556	$562,753	$191,214	$2,001,108	$1,573,438	$1,184,268
Autocar Co.	6,321	2,196	1,260	15,775	17,324	1,956	6,452	7,471	4,074	29,831	27,450	14,994
Brockway Motor Co.	7,493	2,738	631	2,887	2,520	2,029	1,997	1,923	2,995	12,377	7,182	5,655
Diamond T Motor Car Co.	11,515	9,779	1,134	12,787	13,751	7,364	11,302	13,477	4,870	35,897	37,287	13,634
Federal Motor Truck Co.	6,024	4,596	756	4,341	5,347	1,866	1,305	2,174	350	12,277	13,262	2,972
Hudson Motor Car Co.	12,355	7,225	5,620	3,805	5,278	6,346	1,885	1,375	692	34,902	46,217	15,354
International Harvester Co †	173,693	162,218	87,287	142,151	125,944	133,114	71,890	78,226	107,091	387,734	366,388	327,493
Mack Trucks, Inc.	27,529	5,900	6,143	29,457	28,690	26,022	12,802	21,323	16,489	69,788	55,913	48,654
Marmon-Herrington Co., Inc.	3,854	4,437	3,817	6,128	8,223	5,040	5,474	2,012	739	16,996	16,331	10,367
Nash-Kelvinator Corp.‡	36,106	21,890	20,157	5,326	9,408	12,800	24,633	7,687	5,212	81,557	52,537	38,170
Packard Motor Car Co.	44,241	26,587	35,166	12,264	12,457	12,758	24,341	19,281	5,557	123,367	100,486	70,459
Sterling Motor Truck Co.†	1,090	763	248	1,903	1,068	1,190	1,165	518	602	4,157	2,350	2,041
Studebaker Corp.	26,372	17,520	15,498	21,718	16,706	11,670	31,510	23,175	6,972	80,566	58,138	34,617
Willys-Overland Motors, Inc.	13,342	1,325	1,302	15,170	11,091	2,739	15,930	46,232	1,593	54,595	62,527	7,358
White Motor Co.	9,904	5,901	2,019	22,388	14,916	17,137	15,194	18,995	9,864	47,487	39,811	29,020
Total	$379,839	$275,075	$181,038	$296,100	$272,723	$249,233	$225,881	$243,869	$167,100	$991,531	$885,879	$620,788
Grand Total	$1,064,384	$707,343	$732,121	$1,000,375	$851,140	$660,046	$836,437	$806,622	$358,314	$2,992,639	$2,459,317	$1,805,056

*—Includes unbilled costs: $55,871,967 for 1943, $40,989,460 for 1942. †—For years ending October 31st. ‡—For years ending September 30th.

	CURRENT LIABILITIES			RESERVES			EARNED SURPLUS—END-OF-YEAR			CAPITAL STOCK AND CAPITAL SURPLUS		
	1943	1942	1941	1943	1942	1941	1943	1942	1941	1943	1942	1941
Chrysler Corp.	$188,828	$118,217	$59,416	$41,699	$27,922	$18,496	$140,246	$129,977	$129,677	$47,714	$47,714	$47,714
General Motors Corp.	814,718	661,524	497,593	121,268	78,175	93,500	614,859	561,364	493,883	659,449	630,509	630,352
Total	$1,003,546	$779,741	$557,009	$162,967	$106,097	$111,996	$755,105	$691,341	$623,560	$707,163	$678,223	$678,066
Autocar Co.	25,378	21,742	10,631	800	960	800	3,222	1,736	1,117	6,224	6,224	6,224
Brockway Motor Co.	8,195	3,245	1,879	295	123	56	1,236	1,089	931	3,722	3,712	3,692
Diamond T Motor Car Co.	31,961	34,420	11,510	7	512	10	5,695	3,793	2,170	2,028	2,028	2,028
Federal Motor Truck Co.	9,648	10,928	945	.....	.....	.....	1,583	1,125	784	2,458	2,458	2,458
Hudson Motor Car Co.	14,519	30,971	4,716	2,730	1,471	714	12,800	11,480	5,556	19,807	19,807	19,975
International Harvester Co.†	87,215	80,360	73,477	79,538	78,754	59,321	116,748	107,385	98,169	251,501	251,501	251,501
Mack Trucks, Inc.	40,968	27,179	21,260	2,500	2,000	1,000	11,955	12,780	10,790	28,864	28,864	28,864
Marmon-Herrington Co., Inc.	17,300	17,371	12,250	600	739	156	1,382	1,130	152	500	500	500
Nash-Kelvinator Corp.‡	48,310	22,372	12,965	4,413	4,637	4,988	19,308	17,338	15,655	27,895	27,895	27,895
Packard Motor Car Co.	90,613	72,348	50,597	3,000	2,000	.....	10,501	7,246	4,018	42,017	42,017	42,017
Sterling Motor Truck Co.†	2,737	944	922	43	33	37	932	854	538	714	722	774
Studebaker Corp.	57,921	37,657	17,735	2,000	500	.....	11,124	8,844	6,796	20,511	19,501	19,500
Willys-Overland Motors, Inc.	44,856	57,017	5,551	6,363	2,253	13	1,271	d1,729	d2,995	13,585	14,170	14,169
White Motor Co.	25,896	19,329	11,869	2,831	4,381	1,782	6,122	4,028	1,620	20,805	20,805	20,805
Total	$505,517	$435,883	$236,307	$105,120	$96,363	$68,877	$203,879	$177,099	$145,301	$440,631	$440,204	$440,402
Grand Total	$1,509,063	$1,215,624	$793,316	$268,087	$202,460	$180,873	$958,984	$868,440	$768,861	$1,147,794	$1,118,427	$1,118,468



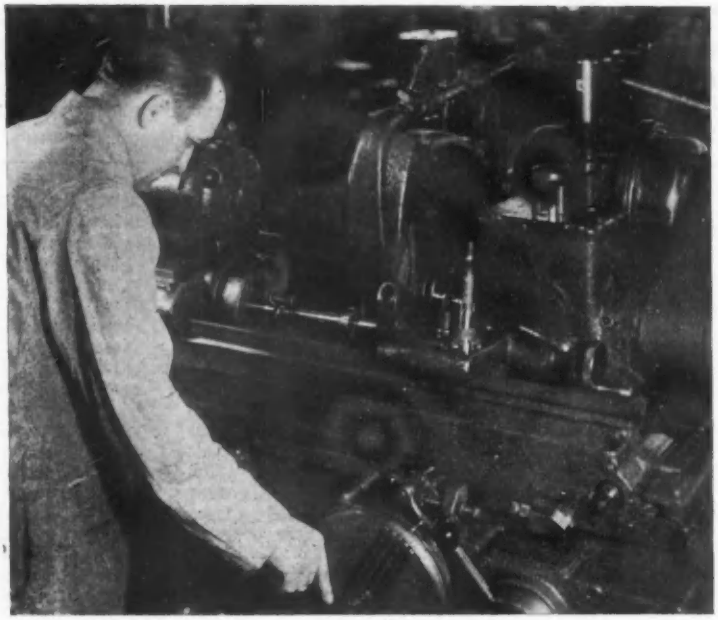
Ex-Cell-O

You may recall the thrilling story of the argosy of 18 Navy men from the minesweeper Quail who made their escape from Corregidor to Australia. That 36-foot boat was powered by a small Navy-built Diesel engine fitted with an Ex-Cell-O fuel injection system. This dramatic episode was a tribute to the reliability of a propulsion unit which is typical of the equipment produced by the Norfolk Navy Yard.

From its very beginnings the Ex-Cell-O fuel injection system was intended to provide a domestic source of supply for producers of high speed automotive type Diesel engines. Needless to say, the organization has proved to be of inestimable value as a source of supply during the war when the demand for Diesel power attained unprecedented levels.

The Ex-Cell-O Diesel Division is housed in a separate plant in Detroit, fully equipped for the production of components and the assembly and testing of finished units. At the present writing, it is producing five different units—three versions of the Model A; and two of the Model B. Design details have been worked out skillfully as to permit of the interchangeability of well over 90 per cent of components for each model. This feature, coupled with the fact that changes and improvements over a period of years have been made without affecting interchangeability of component parts, has been instrumental in easing the burden of servicing through a pipeline that girdles the globe.

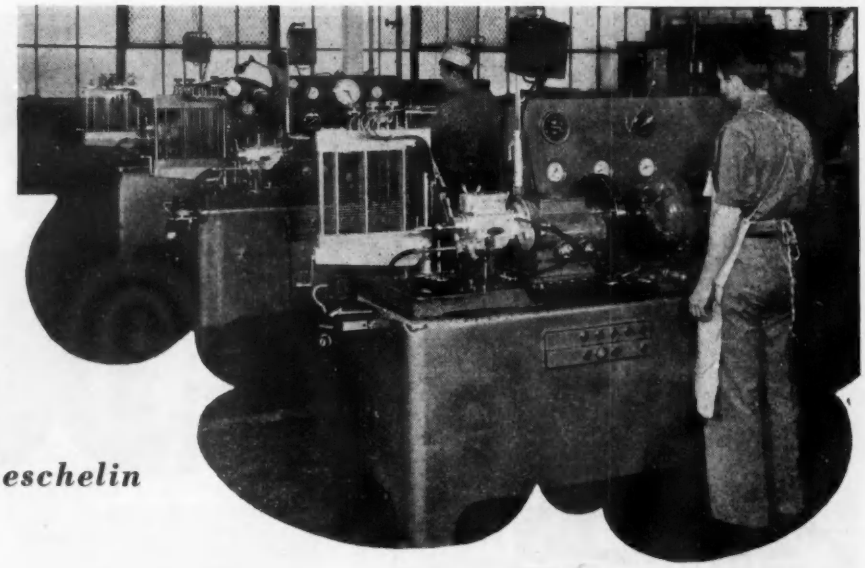
The plant is nicely departmentalized to facilitate the various phases of manufacturing. Among the major of these divisions are the following: a self-contained department for finishing nozzles and injectors; a lapping room for finishing the variety of bores in the housings and parts; drill press department; precision boring department; milling machine department; grinding department; assembly and test floor. For the primary operations on screw machines, turret lathes,



One of several types and makes of modern grinders used in this plant.

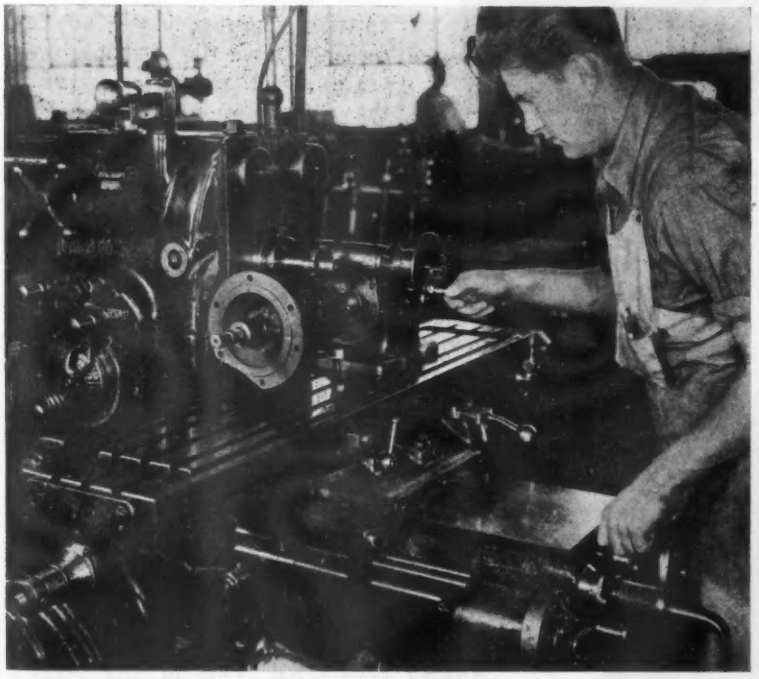
Here is a general perspective of the final bench assembly department in which the Diesel fuel pumps are integrated.

View in final test department where all Diesel fuel pumps are checked for calibration on equipment designed and built for the purpose by Ex-Cell-O.



By Joseph Geschelin

Fuel Injection Equipment in Production



Closeup of one of the fussy milling machine operations on a fuel pump body.

Bullards, etc., the Diesel division draws upon the extensive facilities offered by other divisions of the corporation.

As one might surmise, the lion's share of standard and special machinery found here has been developed and supplied by the machine division of Ex-Cell-O. In this category are adaptations of the versatile Ex-Cell-O precision boring machine; a battery of Ex-Cell-O lapping machines fitted with newly available diamond laps; and a variety of small special purpose machines of unique design. Among these is a small bench type cylindrical grinder for forming the pintle; and another bench type machine which bores an intricately-formed hole in the nozzle.

Owing to the use of cast iron for the major housings and covers, advantage is taken of the exceptional speed and fine finish produced by cemented-carbide tools. Milling cutters, for example, are fitted with cemented-carbide-tipped blades. Precision boring machines are fitted with fly-cutters tipped with specific grades and makes of c-t-c depending upon the application.

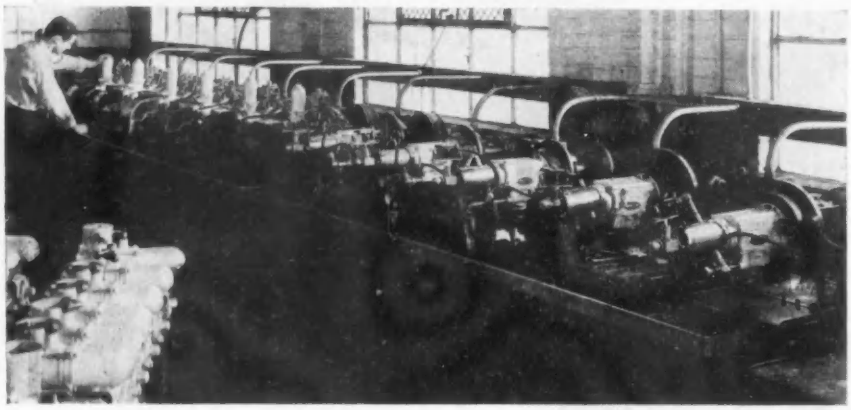
A comprehensive system of overhead-mounted power distribution duct serves all machine lines. In addition to good housekeeping, it provides a ready means of moving machinery at will or adding new machines without disturbing the main wiring system.

Ex-Cello-O has made an extensive study of lapping methods to facilitate the perfection of many bored holes used in the mechanism. Gradually the conventional techniques of hand lapping have given way to machine lapping. Today, all lapping is done on Ex-Cello-O machines fitted with newly developed diamond lapping tools which are capable of removing an appreciable amount of metal rapidly and to perfection. Small cylindrical pieces such as plungers are lapped in a Norton machine, using a cast iron lapping plate.

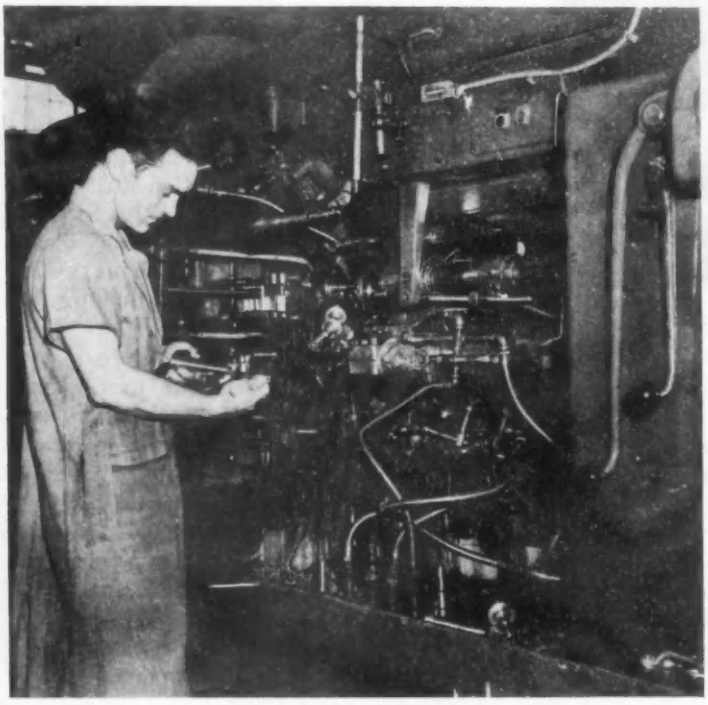
Assembly operations are progressive in character,

View in the lapping department. Here is a battery of Ex-Cell-O lapping machines.

Ex-Cell-O Diesel fuel pumps are run-in initially, following assembly on this battery of machines. The Model KD pump is in the foreground.



In the automatic screw machine department — one of the enormous automatics employed in the production of fuel pump parts.



starting with the integration of sub-assemblies which are fed to the final assembly benches. In some instances where clearances between mating parts are exceedingly fine, the assembly process is selective. This is true of the fitting of plungers in hydraulic units and of the fitting of steel balls in check valves.

Following assembly, the pumps are run-in on a battery of test stands. Then they are subjected to a test schedule on special, Ex-Cell-O built, testing machines for calibration and proving of nozzle distribution.

From the standpoint of conservation of materials, it is of interest to find that three parts of the housing—one of these being a long cover for the governor mechanism—are made of molded plastic. Moreover, all pipe plugs used for sealing during shipment also are of plastic to avoid wastage of hard-to-get cast iron plugs.

Quality control is necessarily an important function considering the fine tolerances on bores and cylindrical fits and the insistence upon fine surface finish.

Having considered some of the general background, we have selected a few major parts for more extended study, touching on the general sequence of operations. Consider first a typical pump body. Machining operations are preceded by inspection, snagging, and normalizing of rough castings. For normalizing, castings are heated to 900-1000 F, then cooled in the furnace. The initial machining takes place in two settings on Mult-Au-Matics to prepare for the major boring and facing operations. The bearing liner is pressed in, then is spot-faced, and

(*Turn to page* 112, *please*)

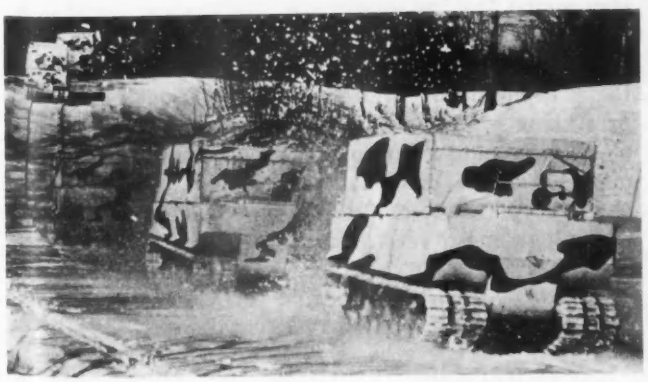
The Army

Weasel

a Studebaker War Product

It is claimed that the M-29 can operate over a greater variety of terrain than any other vehicle and will traverse snow, deep mud, swamp land, sand, paved highways, and steep slopes, an example of which is shown in the above photo. The broad full-length tracks are equipped with rubber pads. Pressure exerted on the ground by it is said to be about one-fourth that of a fully-equipped infantryman.

The Weasel is designed either for Arctic reconnaissance or Commando raids. For operation over snow-covered lands, it is camouflaged in black and white as shown below. The top is the demountable type.



In secret production for almost two years on converted automobile assembly lines at the Studebaker plant, this new track-laying type military vehicle is powered by Studebaker's Champion six-cylinder passenger car engine located in front and at the right of the driver. Designated officially by the Army as the M-29 Cargo Carrier, it is called the "Weasel" because of its swift and evasive striking power. The project for this type of personnel and supply carrier was placed in May, 1942 with Studebaker by the Army Ordnance Dept. and within 34 days the first experimental job was ready for testing, the start of a development program that resulted in this completely new vehicle.

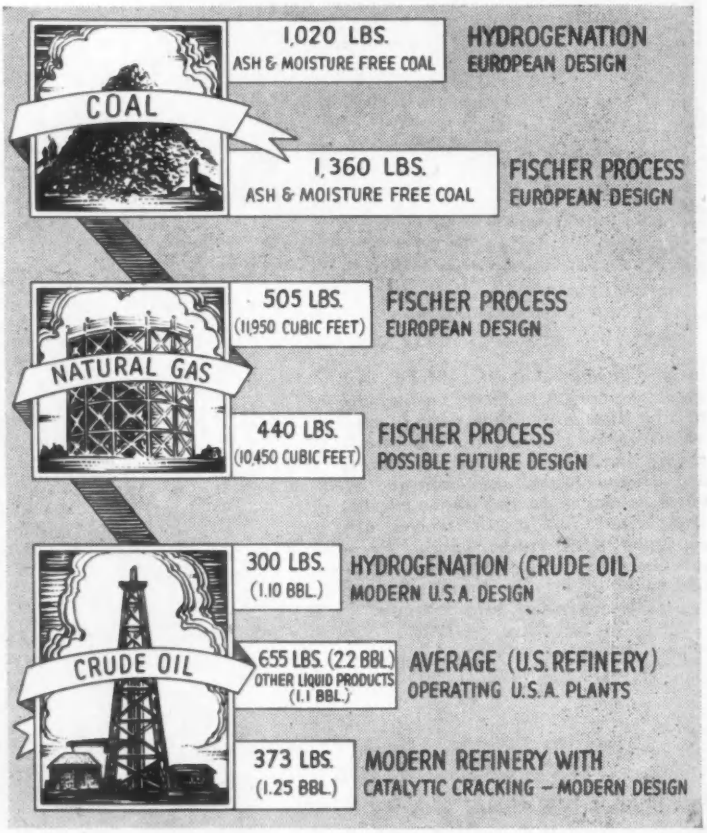
Natural Gas, Coal and Shale Oil

Reserves Ensure America's

THIS article is the second and concluding discussion prepared by Mr. Hirsch on the mineral fuel reserves of the United States. The first article, "Our Crude Oil Outlook," was published in the July 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES.

TOTAL RAW MATERIALS REQUIRED TO PRODUCE ONE BARREL OF GASOLINE

including Requirements for Power, Steam, etc.



Courtesy of Bureau of Mines, U. S. Dept. of Interior

A REASSURING picture of available supplies as well as of reserves is reflected by the latest statistics of the production of gasoline from natural gas. This makes all the more cheerful reading as Deputy Petroleum Administrator Ralph W. Davies, in all of his recent public utterances, has emphasized that an important part of the *must* ingredients of an efficient aviation fuel can be obtained from natural gasoline and that "a finished aviation fuel may be produced *altogether* from natural gas and its derivatives." Natural gasoline and condensates reserves are estimated at approximately 2 billion barrels and conversion into gasoline of the currently accepted estimate of natural gas reserves would add another 6 billion barrels to the supply. Output of natural gasoline at the present time is estimated to exceed 55 million barrels a year. A fair idea of the growth of natural gasoline consumption may be gained from a recent Bureau of Mines tabulation of the amounts of natural gas treated at natural gasoline plants in the five-year period from 1937 to 1941.

Natural Gas Treated at Natural Gasoline Plants
(in Millions of Cubic Feet)

1937	2,108,800
1938	2,035,562
1939	2,150,000
1940	2,471,400
1941	2,763,300

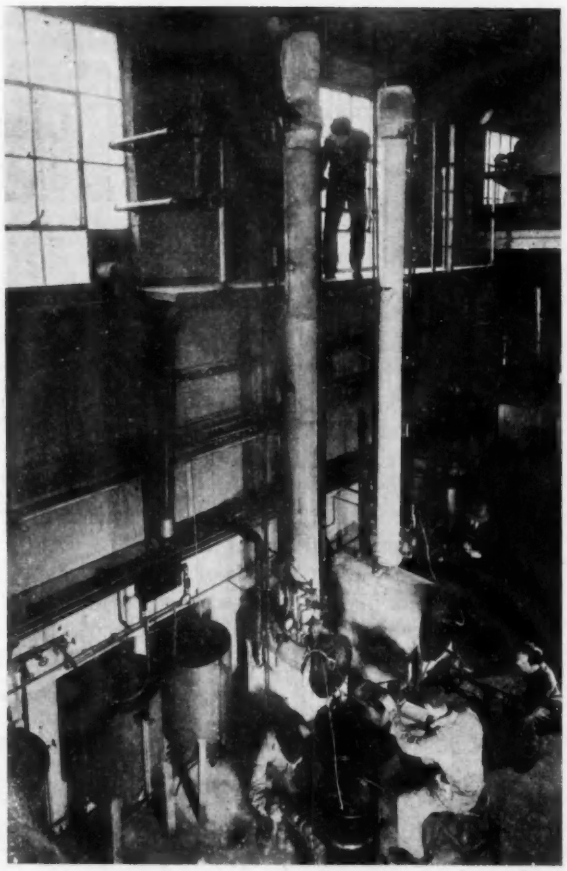
In the four years (1938-41) there was a sharp climb in the volume of gas treated for natural gasoline, amounting to 36 per cent in all.

Speaking of natural gas reserves, Lyon F. Terry, second vice-president of the Chase National Bank, New York, and a recognized authority on the subject, put it this way in an address before the American Gas Association: "Our known reserves are equivalent to 27½ times annual withdrawals on a wartime basis or about 33 times annual requirements for the prewar period."

Natural gasoline operations, as carried on today, permit selectivity in the choice of hydrocarbons and their composition in definite proportions. In the processing of wet natural gas in the modern cycling plant, maximum aviation fuel production with a minimum of critical materials is obtained. Natural gas yields large portions of isoctane, alkylate, cumene, isopentane and other valuable constituents in the production of aviation fuel. Switchover to the finishing of 87 or 91 octane aviation fuel from the production of ordinary motor fuel entails but a minor change in the operation setup. Because of its tran-

By W. C. Hirsch

Gasoline Supply

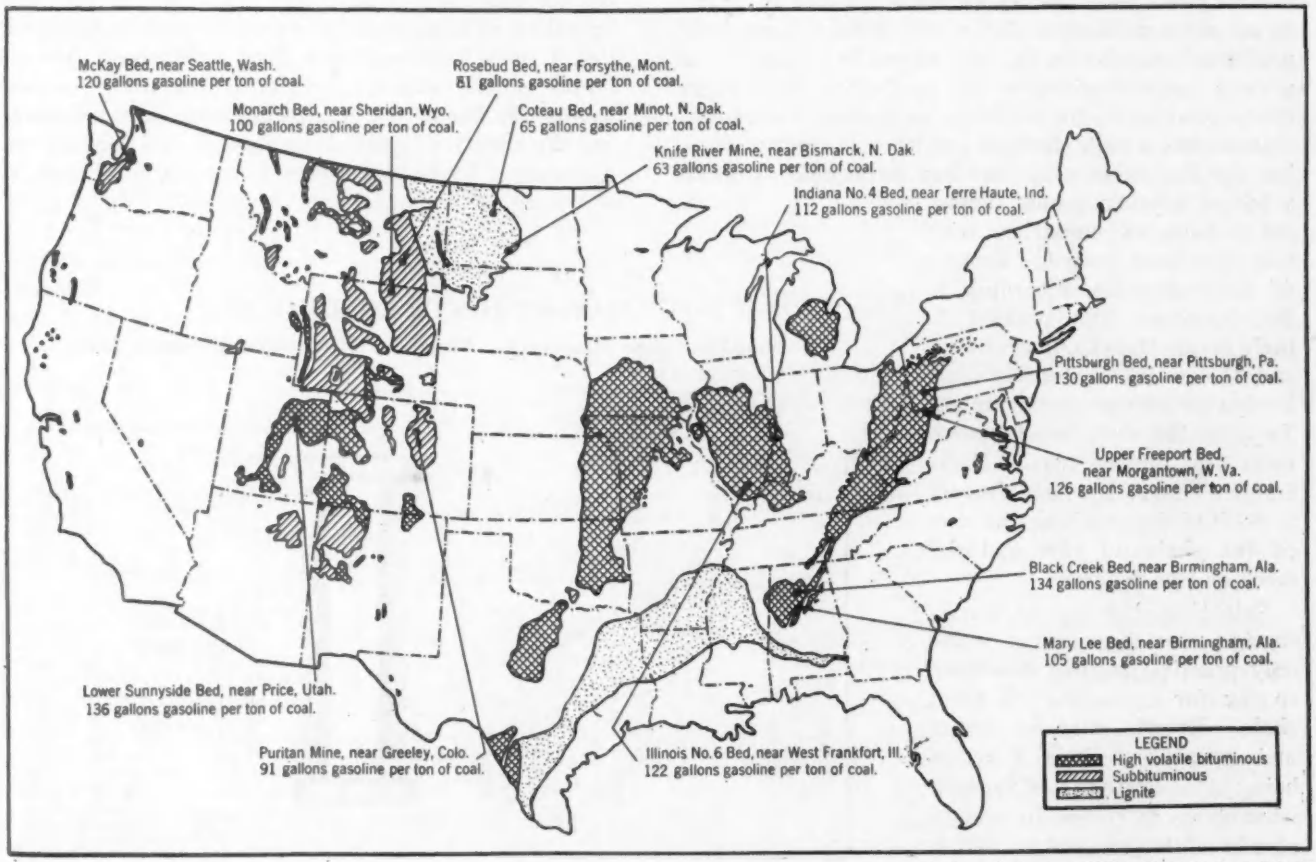


scendent importance as path-maker in this direction, a recent warning note of the Petroleum Administration for War may well be heeded. In 1941 the known loss and waste of gaseous hydrocarbons in the United States amounted to nearly as much as the Germans had available in total hydrocarbons for their 1942 war machine. And a competent analyst of this precarious

(Right)—Small-scale "cracking" unit at the Bureau of Mines coal hydrogenation plant at Pittsburgh, Pa. The medium oil contained in the first stage of coal liquefaction is transported to this still, and is "fractionated" to produce more gasoline, Diesel oil and other products. In the first stage the coal yields about 20 per cent gasoline and 80 per cent medium oil. This photo is reproduced here by courtesy of the Bureau of Mines.

CONVERSION OF COAL TO GASOLINE

Yields from coals tested in Bureau of Mines Hydrogenation Plant


McKay Bed, near Seattle, Wash.
120 gallons gasoline per ton of coal.
Rosebud Bed, near Forsythe, Mont.
81 gallons gasoline per ton of coal.
Monarch Bed, near Sheridan, Wyo.
100 gallons gasoline per ton of coal.
Coteau Bed, near Minot, N. Dak.
65 gallons gasoline per ton of coal.
Knife River Mine, near Bismarck, N. Dak.
63 gallons gasoline per ton of coal.
Indiana No. 4 Bed, near Terre Haute, Ind.
112 gallons gasoline per ton of coal.
Pittsburgh Bed, near Pittsburgh, Pa.
130 gallons gasoline per ton of coal.
Upper Freeport Bed,
near Morgantown, W. Va.
126 gallons gasoline per ton of coal.
Black Creek Bed, near Birmingham, Ala.
134 gallons gasoline per ton of coal.
Mary Lee Bed, near Birmingham, Ala.
105 gallons gasoline per ton of coal.
Lower Sunnyside Bed, near Price, Utah.
136 gallons gasoline per ton of coal.
Puritan Mine, near Greeley, Colo.
91 gallons gasoline per ton of coal.
Illinois No. 6 Bed, near West Frankfort, Ill.
122 gallons gasoline per ton of coal.
LEGEND
High volatile bituminous
Subbituminous
Lignite

Courtesy of Bureau of Mines, U. S. Dept. of Interior

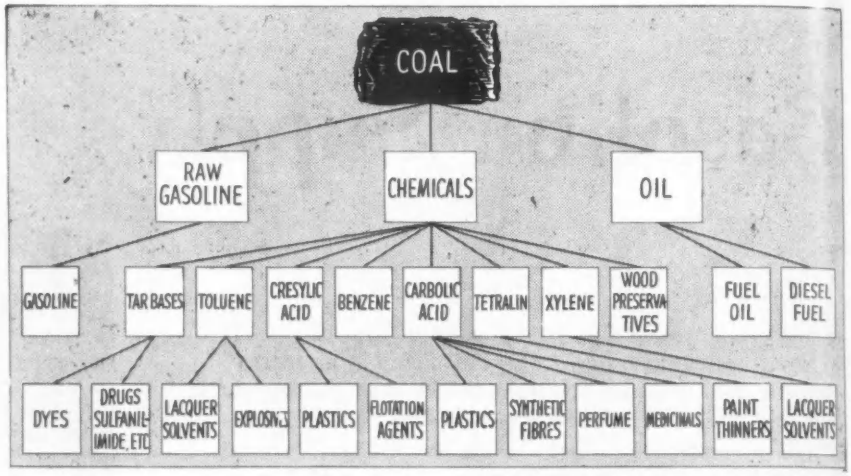
situation points out that, although there is some unavoidable loss in transportation of natural gas through leakage, the greater part of the loss was *preventable waste.*

Interwined with misgivings concerning the adequacy of oil reserves is the subject of oil shale deposits. Bureau of Mines geologists estimate that these shales could be made to yield more than 90 billion barrels of oil. Arnold C. Fieldner, chief of the fuels and explosives service of the Bureau of Mines, in testimony before a Senate subcommittee, significantly referred to the utilization of oil shales as part of *a third line of attack* of the oil problem, placing more exploratory work — more drilling and wildcatting—*first;* and improvement of refining methods *second.* Also at a Senate subcommittee hearing, following detailed explanation of how he arrived at his figures, A. J. Kraemer, senior refining engineer of the Bureau of Mines, estimated the cost of a barrel of oil, produced from shale, at $2. The Bureau of Mines conducted an experimental shale oil plant in Colorado until 1929, when it was closed. Since then no noteworthy preparatory steps to bring about shale oil production on a commercial scale have been reported. Several million (metric) tons of oil shale a year were produced annually in Scotland in prewar years, that country having outranked all others in oil shale utilization for a long time. Very little useful information on the subject can be gleaned from prewar records of shale oil production in foreign lands. Esthonia, for instance, came in for considerable attention as a shale oil producer in prewar days, but the Esthonian producers had the benefit of an $8 a barrel subsidy, which throws out of focus all comparison with non-subsidized output. Japan's oil shale deposits, according to Mr. Kraemer, run parallel to their South Manchurian railway, and the entire deposit is overburden of extensive coal mines. To mine the coal, the Japanese must first remove the oil shale. So they charge the cost entirely to coal mining, making the cost of the shale oil raw material more or less fictitious.

Retorting, heating or distilling in a special apparatus, is the only practical method developed so far for extracting oil from shale. Retorts vary in design and operation, their function being to separate the oil formed, when shale is heated to a sufficiently high temperature, from the gas and water vapor on the one hand and the mineral matter or ash on the other. The products of such retorting operations contain from 10 to 20 per cent oil, the remainder being spent shale and water vapor and gas. In the absence of shale oil production on a commercial scale in the United States, cost remains conjectural, but Bureau of Mines technicians estimate that the cost of automobile gasoline, derived from shale oil, would range from 9.7 to 10.7 cents a gallon.

Enactment into law of the O'Mahoney Synthetic Fuel Oil Bill (S. 1243), which makes available a $30,000,000 appropriation for "the construction and operation of demonstration plants to produce synthetic liquid fuels from coal and other substances" has directed general attention to the hydrogenation of coal as possibly one of the long-term means of supplementing the supply of gasoline and oil, should this become necessary. By hydrogenation is meant the conversion

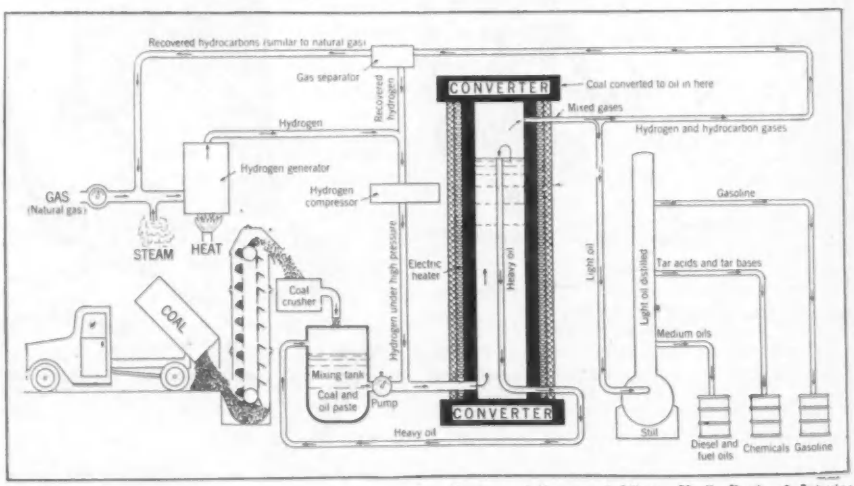
PRODUCTS FROM COAL



Courtesy of Bureau of Mines, U. S. Dept. of Interior

CONVERSION OF COAL TO OIL

Simplified flow diagram for Bureau of Mines Hydrogenation Plant



Courtesy of Bureau of Mines, U. S. Dept. of Interior

of coal into liquid carbons by heat and pressure in the presence of free hydrogen and catalysts. Since 1937, the Bureau of Mines had been operating a small-scale hydrogenation plant at Pittsburgh, capable of handling not more than a hundred pounds of coal a day. Accompanying this article are illustrations that give a graphic outline of the procedure of converting bituminous coal into gasoline.

Imperial Chemical Industries is operating a direct hydrogenation plant in England with a capacity of approximately 3500 barrels a day. Germany, which is credited with having pioneered the commercial production of petroleum from coal and lignite by direct and indirect hydrogenation, is thought to have had at the outbreak of the war an annual capacity of 35,000,000 barrels of hydrogenated oil. How far the process has been developed in Japan is not known, but that the Japanese have some hydrogenation plants in operation and that others are running in Nazi-occupied France is current information. Secretary Ickes has repeatedly stated that one-third of Hitler's Luftwaffe was fueled with synthetic gasoline.

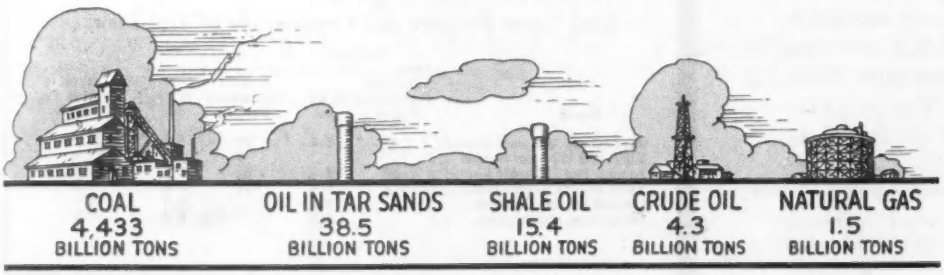
In terms of British Thermal Units a comparison of coal reserves, the potential source of supply of the raw material for hydrogenated oil, with the reserves of other basic fuels presents the following picture:

	U. S. Reserves in Trillions of BTUs	1942 Output in Trillions of BTUs	Ratio 1942 Output to Reserves
Coal	67,106,828	17,520	1:3830
Petroleum	118,000	8,400	1:14
Oil Shale	579,000	None	
Natural Gas	104,500	3,300	1:32

BTU Reserves based on Report of National Resources Committee report as of Jan. 1, 1937—3,180,765,220,000 net tons of coal. Oil recoverable from shale, estimated by D. E. Winchester, Bureau of Mines, at 91,944,885,400 bbl.; Petroleum proved reserves, as of Dec. 31, 1942, reported by American Petroleum Institute, 20,082,793,000 bbl.; Natural Gas, preliminary estimate of proved reserves of natural gas by Petroleum Administration for War—97,144,000,000,000 cubic feet.

KNOWN FUEL RESERVES

Western Hemisphere 1942.



Regarding the cost of the hydrogenated product Secretary Ickes recently made the following statement: "We have plausible estimates ranging from 12 to 25 cents a gallon. This is two to four times the cost of gasoline from petroleum. If the cost of production can be held at the lower figure, the retail price of gasoline recovered from coal should not exceed the average price of petroleum gasoline by more than 10 cents a gallon at the most. It is possible that the cost could be brought still lower through chemical research. For example, 5 tons of high-volatile bituminous coal, 6½ tons of sub-bituminous coal or 9 tons of lignite are used by the direct hydrogenation process making 1 ton of gasoline; only about 40 to 45 per cent of the original heat remains in the resulting motor fuel. Perhaps a method could be developed whereby some of this lost energy might be retained."

Production of gasoline from coal involves the two major steps of hydrogenation of coal into heavy oil and hydrogenation of heavy oil to gasoline. The second of these stages entails a procedure with which oil refining technicians in the United States are well acquainted, but in the first step, that of the hydrogenation of coal into heavy oil a number of problems, such as that of the most efficient preparation of coal for hydrogenation, have to be studied with particular reference to cost. In fact, the future of hydrogenation will be determined almost altogether by the cost of the process and product. Cost and cost alone will also determine postwar activity in the recovering of oil and

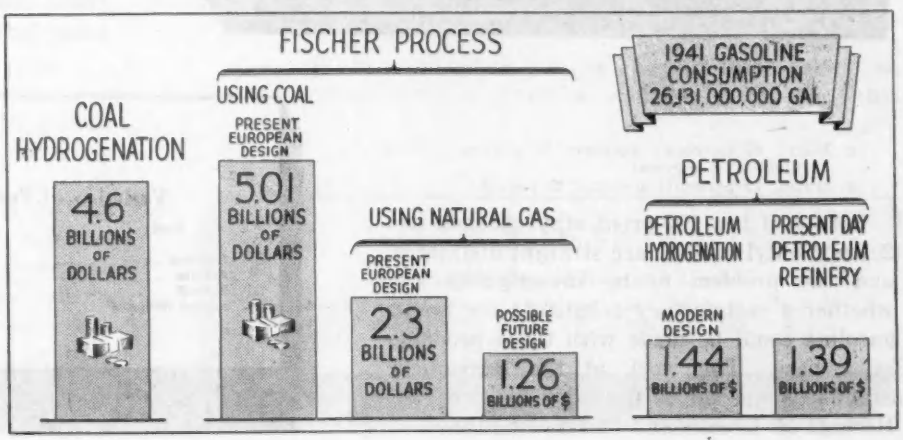
(*Turn to page* 106, *please*)

ANNUAL U. S. GASOLINE BILL

(At Refineries)

USING VARIOUS PROCESSES

(Before taxes and without profit to the manufacturer)



Carbohydrate-Base

IT WOULD be of great practical importance if the large numbers of American automotive units which have been and are still being shipped abroad could be operated on locally produced fuels. Most of the countries in which these units are being operated have no petroleum sources of any importance, but could readily produce large quantities of alcohol. With this situation in mind, the Bureau of Supplies of the Foreign Economic Administration, with the assistance of the National Bureau of Standards, carried through an experimental investigation bearing on the use of alcohol and various alcohol blends in modern automotive engines. In addition to the ordinary ethyl or grain alcohol, butyl alcohol could be made available, which in the "as-distilled" condition contains from 20 to 27 per cent acetone and from 5 to 8 per cent ethyl alcohol. The program therefore covered two groups of fuels, as follows:

Group 1
- a. Ethyl alcohol 190-proof } With additives
- b. Ethyl alcohol 200-proof } for cold starting

Group 2
- a. Butyl (pure) with additives for cold starting
- b. Butyl, 50 percent; acetone, 50 percent
- c. Butyl, 67 percent; acetone, 27 percent; ethyl alcohol, 6 percent
- d. Butyl, 72 percent; acetone, 28 percent

Both fuel 1-a, 190-proof ethyl alcohol, and 2c, raw butyl alcohol, are straight distillates, and the problem to be investigated was whether a satisfactory substitute for motor gasoline could be made with these products as a base. The work at the Bureau of Standards was under the supervision of Dr. Herbert B. Brooks and Clarence S. Bruce.

Among automotive engineers there has been, in the past, an impression that when alcohol is used as motor fuel it increases the rate of bore wear. However, there is no record of any carefully conducted tests in which the alcohol was not blended. With gasoline-alcohol mixtures containing less than 20 per cent alcohol, a binding agent is required to prevent segregation, and the binding agent used evidently has been largely responsible for the excessive bore wear noted with European alcoholized fuels. There was no excessive bore wear with any of the substitute fuels used in these tests.

"Handling qualities" of the various substitute fuels was the first item given consideration. This involved determination of losses by evaporation, of vapor-lock tendencies, of the effect of the fuel on fuel-pump mechanisms, and of the distillation characteristics.

The Bureau of Standards ingeniously combined endurance tests for fuel pumps with tests for evaporation loss. The pump dia-

Table II

Reid Vapor Pressure and Composition of Test Blends

Blend	No Lock: Volatile Constituent Percent	No Lock: R.V.P. psi.	Light Lock: Volatile Constituent Percent	Light Lock: R.V.P. psi.	Temperature Degrees F Light Lock
Acetone and 190-proof Alcohol	42	5.4	57	5.7	89.0
Ether and 190-proof Alcohol	..	..	9	5.3	88.2
Acetone and 200-proof Alcohol	50	4.5	59	5.0	86.2
Ether and 200-proof Alcohol	7	5.0	11	5.5	94.3
Iso-pentane and Gasoline	..	9.0	..	9.8	88.0
Iso-pentane and Gasoline	..	8.9	..	9.9	89.0

Table I

Relative Evaporation Losses of Fuels

Fuel	Relative Loss Rate
Gasoline	60
Acetone	25
Butanol	1
Alcohol, 190 proof	10
Fuel No. 1—50 percent Acetone, 50 percent Butanol	12
Fuel No. 2—27 percent Acetone, 67 percent Butanol and 6 percent Ethanol	7
Fuel No. 3—28 percent Acetone, 71½ percent Butanol	7

Table III

Variation of Fuel Among Cylinders, in Per Cent

Fuel	Percent	Fuel	Percent
Gasoline	7	Alcohol 200-proof	28
Acetone	15	No. 1	17
Butanol	54	No. 2	20
Alcohol 190-proof	33	No. 3	23

By Alex Taub
Chief Engineer, Bureau of Supplies,
Foreign Economic Administration

Motor Fuels

Table IV

Power and Fuel Consumption Tests—Engine A

Fuel	At Maximum Power		At Maximum Economy		Maximum Thermal Efficiency, Percent On Heating Value	
	Power Bhp	Fuel Cons. Lb/hr	Min S.F.C. Lb/bhp-hr	Fuel Cons. Lb/hr	Higher	Lower
Gasoline	46.3	26.0	.495	21.5	25.6	27.4
Alcohol, 200-proof	47.5	42.7	.788	34.5	25.4	28.0
Alcohol, 190-proof	46.5	44.0	.825	35.5	26.2	29.2
Acetone	46.7	41.0	.785	34.0	24.6	26.5
Butanol	45.8	35.0	.653	28.0	25.2	27.4
Blend No. 1	47.0	38.6	.690	30.6	25.6	27.8
Blend No. 2	47.0	37.0	.675	30.3	25.7	27.9
Blend No. 3	47.0	36.5	.660	29.4	25.9	28.2

phragm was not affected by any of the fuels. Each fuel system included a tank, lines, and two fuel pumps, and at the start of the test it contained 3 liters of fuel. The fuel was pumped continuously from each tank, and was returned to the tank through ¼-in. copper tubing, which discharged 1½ in. above the "full" level of the tank. The return lines entered the tanks through 1¼-in. lengths of ⅜-in. tubing, which allowed a slight aeration, and also provided for "breathing." The evaporation loss was measured after a definite period of operation, during which no fresh fuel was added. The losses, in milliliters per 24-hr day, are given in Table I.

These tests established two important facts, namely (a) that fuel pumps as used on Plymouth, Chevrolet and Ford engines are not adversely affected by these substitute fuels, and (b) that with all of the substitute fuels the loss by evaporation is far less than with gasoline.

Comparative tests were made to determine the vapor-locking tendencies of the various substitute fuels and of gasoline. Vapor lock is caused by vaporization of fuel in the system by heat radiated by or conducted from the engine or exhaust channels. The higher the percentage of volatile elements in the fuel, the more easily it will vaporize in the supply system under adverse conditions. Fuels, therefore, must be rated for vapor-lock tendency, and the Reid vapor pressure is the index of that tendency. Road tests were made with various mixtures or blends of gasoline and alcohol at atmospheric temperatures of 62 F, 67 F and 70 F. Table II gives the vapor pressures of different blends, each of which contained an admixture of volatiles considered necessary for satisfactory starting.

It will be noted that the Reid vapor pressures of the different alcohol blends are all materially lower than those of the gasolines. There also are only slight differences in the atmospheric temperatures at which light vapor lock occurred. Butanol mixtures were not included in this test, for the reason that butanol is less volatile than ethyl alcohol, so that it was reasonably certain that if ethyl alcohol passed the test, butanol would also. It was thus shown that alcohol with an acetone or ether additive to facilitate starting is superior to gasoline from the vapor-lock standpoint.

Table V

Power and Fuel Consumption Tests—Engine B

Fuel	At Maximum Power		At Maximum Economy		Maximum Thermal Efficiency, Percent On Heating Value	
	Power Bhp	Fuel Cons. Lb/hr	Min S.F.C. Lb/bhp-hr	Fuel Cons. Lb/hr	Higher	Lower
Gasoline[1]	47.4	27.3	.508	22.0	24.9	26.7
Alcohol, 200-proof[2]	49.5	41.3	.700	31.6	28.9	31.6
Alcohol, 190-proof	49.0	42.0	.710	32.7	30.5	33.9
Blend No. 1	47.0	40.9	.730	31.0	24.2	26.2
Blend No. 2	46.8	38.4	.705	30.0	24.6	26.7
Blend No. 3[3]	47.0	39.0	.708	30.5	24.2	26.3
Blend No. 3[1]	46.5	39.0	.720	29.8	23.8	25.8
Blend No. 3[4]	45.8	37.8	.695	29.0	24.6	26.7

[1] Intake riser temperature 215 F
[2] Intake riser temperature 185 F
[3] Intake riser temperature 195 F
[4] Intake riser temperature 420 F

Mixture Distribution

When considering the use of substitute fuels in an internal-combustion engine, we must bear in mind that

Table VI

Starting Mixture—Ether and Alcohol

Percent Ethyl Ether by volume	0	5	10	15	20	25
Percent 95% Alcohol by volume	100	95	90	85	80	75
Lowest possible start, °F	59	37	18	0	−7	−20 (Approx.)

Table VII

Comparison of Blend

Ether	Alcohol	A.S.T.M. Motor	C.F.R. Research
0	100	92.2-90.7-92.7	
10	90	91.5	
15	85		
20	80	90.0	
25	75	89.6	
30	70	88.3	
35	65	86.3	
40	60	85.2	97.9-98.2-97.9
45	55	82.3	88.2-89.8-91.2
50	50	74.4	68.3-66.2
55	45	52.0	29.9-34.1
60	40		

the modern engine is the result of a tremendous amount of development work, and that none of its parts has been given more study than the inlet manifold. If mixture distribution is poor, losses in output and in economy result, and there may be an increase in wear or corrosion in the bores of certain cylinders. It has long been known that the "wetter," or the richer, the mixture, the more difficult it is to obtain equal distribution of fuel between the cylinders of a multicylinder engine. Within the range of mixture ratios required by automotive engines using gasoline, good distribution can be had at part throttle with mixture ratios of from 14:1 to 18:1. However, under full-throttle conditions, which call for 11:1 to 13.5:1 mixtures, a 5 per cent variation in mixture ratios between individual cylinders is the best that has been accomplished. Results in this respect naturally vary with seasonal temperature changes, and with under-the-hood temperatures generally. But with alcohol or ethanol the full-throttle mixtures will have ratios of from 11:1 to 8:1, and these are wet mixtures, indeed. We therefore had every reason to expect great variations in the quantities of fuel supplied to different cylinders, and the results obtained bore out these expectations. All tests were conducted on the same engine, and the results are given in Table III.

These results were obtained at full throttle and at a speed of 1500 rpm. They indicate that under these conditions uniform distribution will present a difficult problem. Part of the difference in variation with gasoline and with the substitute fuels is attributable to the higher heat of vaporization of the latter. When full heat was applied to the manifold, No. 3 fuel (28.5 per cent acetone, 71.5 per cent butanol) showed a variation no greater than that of the more volatile No. 1 fuel, which was 50 per cent acetone and 50 per cent butanol.

Errors in distribution begin at the carburetor flange, since there are no carburetors that permit the mixture to flow into the manifold in a homogeneous cross section. In standard manifolds an effort is made to correct this by introducing a riser sleeve with sharp edges in the manifold, which at least keeps the wet fuel off the manifold walls. This sleeve can be so shaped that it will deflect some of the wet fuel, to balance an existing bias. However, even then a good deal of the wet fuel drops to the normal floor of the manifold, and with mixtures as wet as they are likely to be with alcohol, the floor will be flooded, and control of the direction of fuel flow will be difficult.

It is therefore recommended that a sump be provided in the floor of the manifold to catch the wet fuel. This floor sump must extend into the exhaust manifold and thus provide for vaporization of a portion of the wet fuel that drops into the sump. It may be possible to incorporate in the sump a catalytic surface or series of surfaces to provide the maximum heating area for the vaporization and a partial conversion of the wet fuel. In the case of alcohol, a catalyst might be found which would convert part of the alcohol to ethylene, and the latter, because of its higher volatility, would pass into the air stream and mixture. This would assist in supplying the end cylinders with the proper mixture, which are always a source of trouble.

Another fundamental difficulty with intake manifolds carrying an extremely wet mixture is that on up-

(*Turn to page* 84, *please*)

Table VIII

Heats of Combustion of Test Fuels, Btu/Lb.

Fuel	Total Heat at Constant Volume	Net Heat at Constant Pressure
Gasoline	20,110	13,770
200-proof alcohol	12,720	11,520
190-proof alcohol	11,760	10,570
Acetone	13,180	12,230
Butanol	15,460	14,220
Blend No. 1	14,380	13,270
Blend No. 2	14,650	13,500
Blend No. 3	14,860	13,690

Table IX

Fuel	Equivalent Weight	BTU to Evaporate	Theoretical Temp. Drop of 14 Lb of Air
Gasoline	1.00 lb	140	42 F
100% Alcohol	1.69 lb	622	185 F
95% Alcohol	1.78 lb	737	220 F

Airbriefs

By Henry Lowe Brownback

Pioneers

I read with some amusement a few days ago a newspaper announcement that Mr. ————, a "Pioneer" in the aviation field was going to address a certain business club meeting. The notice then went on to say that Mr. X had been connected with the aviation industry since 1928. If Mr. X is a pioneer in the aviation industry then Mayor La Guardia must be considered one of the founding fathers of New York City. I say this not out of nastiness but because few people connected with the aircraft industry today realize what the real pioneers went through to get airplanes in the air. There has been too much of a tendency on the part of those connected with the airplane business beginning in the schools to belittle the efforts of the pioneers, too much of "Oh they were all right, a bunch of more or less ignorant showmen, gadgeteers and haywire artists, but those days have gone and now is the time for the 'trained' scientist, the production expert, the industrial manager and the financier to take over and really show what aviation is."

The early men in the industry had sublime courage and they worked, and too often died, because they wanted to fly and to have other men fly. They established the basis for all of the knowledge which the trained men are getting today. Perhaps most of them did not go through any great amount of formal schooling—they had not yet laid out the basic science for the schools to take up and teach—but then neither did Mr. Lincoln or Mr. Ford, or Mr. Rockefeller or Mr. Edison or Mr. Carnegie, and yet no one has any doubt that those gentlemen were of great use to the world.

A few of us who went into aviation near its beginning had studied formal engineering, but it did not make us feel superior to Glenn Curtiss, the Wright Brothers, Henry Farman, Louis Bleriot, and many others. In fact we bowed our heads in recognition of the greatness of these great men who, without the benefit of formal education, had laid the basis for a great science and had done what many so-called scientists had failed to do through lack of imagination. Any country or industry, which closes its eyes to the worth of the self-trained man who has through his own effort and study gained knowledge and who has combined with it inventive genius and the courage to go ahead and try the things in which he believes, is shutting one of its largest doors on progress. The school "dunce," who was not stupid but often too busy in his own thoughts and dreams to listen to what the teacher has just been talking about, has often wound up with his name inscribed in the Hall of Fame.

Augustus Post

One of the real giants of Aviation has passed on. Mr. Post believed in aeronautics, believed in it enough to make thousands of balloon ascensions to show the mass that man could fly and, when the airplane came into being, Mr. Post did as much as any living man to make it known to the world by organizing meets, backing fliers, getting publicity for the new machine. Without men like Augustus Post the new baby would have had a far greater task in reaching maturity than it did. Another great man who has done much for aviation and is still doing much has been honored by an honorary degree of Doctor of Laws. Lester Gardner was one of the first to recognize the value of the fragile bundle of sticks and cloth powered by an "unreliable" engine with which man was struggling to fly and had the courage to pioneer the publication of books and magazines dealing with the new science. Reaping his reward and retiring for a well-earned rest, Major Gardner was struck by the fact that aviation had no real scientific center of its own. Two of the principal scientific societies had aviation branches, but that was all. Europe had purely aviation societies which had done great things for aviation. Why did not we? Then came the struggle of starting something new and keeping it on a high scientific and professional plane. The Institute of the Aeronautical Sciences "took off" in modest quarters with little but aspirations and ideals and in competition with the great engineering societies and scientific institutions of the country. Today it has a library which is unequalled in the world as is its collection of aeronautical material. Eveything connected with the Institute shows the genius of a master in the art of organization and the final link has been forged in the magnificent gift of the Guggenheim family of their Long Island estate as a memorial laboratory and science center and the gift of Glenn Martin of enough money to insure its operation. Lester Gardner has done great things in his lifetime and it has been an honor to be numbered among his friends.

The Robots

Lawrence Sperry from that great beyond must feel a sense of vindication even though one of his ideas is being used against us. It was he who first thought of the robot bomber and we were the first to build, but never to use them. In 1918 the Sperry Gyroscope Co., the Dayton Wright Airplane Co. and Harold Will built the parts of the first robot bombers or flying bombs.

Gasoline

If our postwar airplanes are to be used by the masses of people they will have to be different from those of today. I have pointed out before several of these necessary differences but none will be more important than the question of fuel. If planes will all land in airports then the question of proper "gas" will not be difficult to solve but if thousands of landing strips are to be established along the highways of the country the manufacturers of small aircraft engines will be faced with the problem of building machines to operate efficiently on the best grade of motor car gasoline universally available. No amount of printing of fuel specifications in an instruction book will keep John Smith from getting five gallons of premium motor fuel from some filling station and dumping it in the tank.

The art of engine building has advanced steadily in all ways but one and that is probably the most difficult nut of all to crack—getting high power out of low grade fuel. I have occasion to use several makes of small aircraft engines and no one can say that they are not fine pieces of machinery. They all have, however, a taste for fuel which cannot be picked up everywhere. A few years ago I tested all of my engines on premium motor car fuel, but the increased power they are getting from the little jobs of today has made them rather difficult to feed. I also note that an "octane" is no longer an "octane" and some engines require fuel of a certain octane number with a maximum dosage of lead which is rather low. I'm afraid that John Smith will not appreciate the necessity of keeping to these "specs" and trouble may result if he treats his aircraft engines as he used to and the way that he treats the remainder of his mechanical appliances.

A Fisher inspector checking a B-29 fin surface. This photo gives an idea of the size of the bomber's fin.

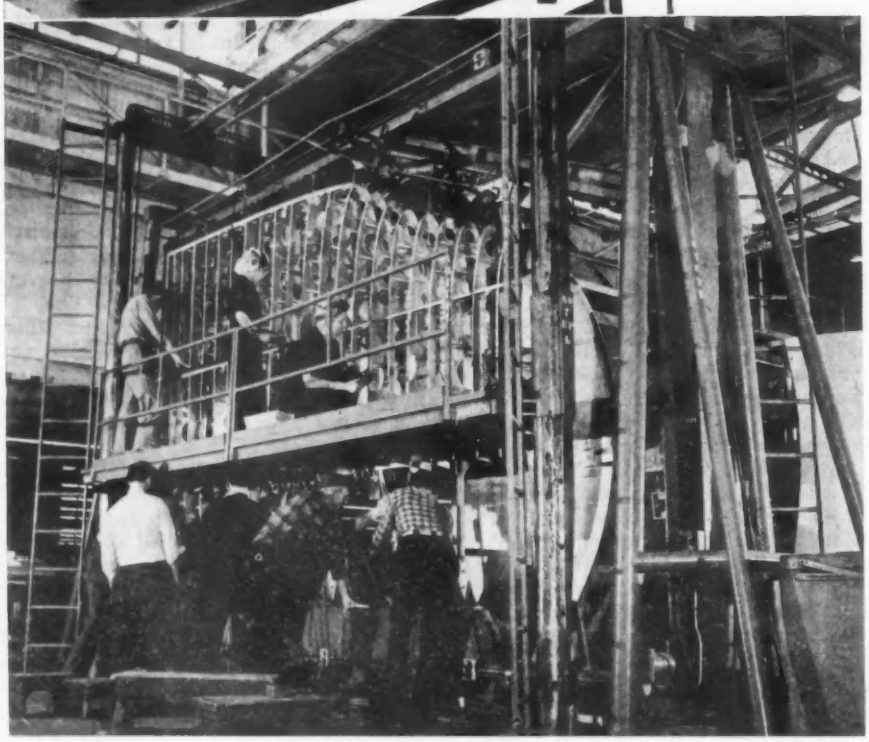
Some B-29

INSTALLED on the new B-29 Superfortress is the Boeing "117" wing of web-type construction. A heavy extruded duralumin chord was selected for the web spar. Weighing 255 pounds, when machined, this chord is the largest extrusion ever used in a production airplane.

The improved features claimed for the Boeing "117" wing, over other wings, are: Decreased drag per pound of lift; increased thickness of the interspar area, permitting greater strength of the primary structure and greater volume in which to carry gasoline; better stall warning and more gradual stalling characteristics. The wing has a span of 141.2 feet with an aspect ratio of 11.5. The trailing edge is approximately straight except for the portion between the inboard nacelles and the fuselage. The trailing edge of the flap in this portion hooks downward, decreasing aerodynamic interference between the wing and the body, and minimizing tail buffeting during climb. To decrease the take-off distance and speed, the flaps are extended 25 degrees at take-off. The flaps roll back and down, increasing the wing area and the downwash angle of the air leaving the wing. When the flaps are extended, the total wing area is increased 19 per cent.

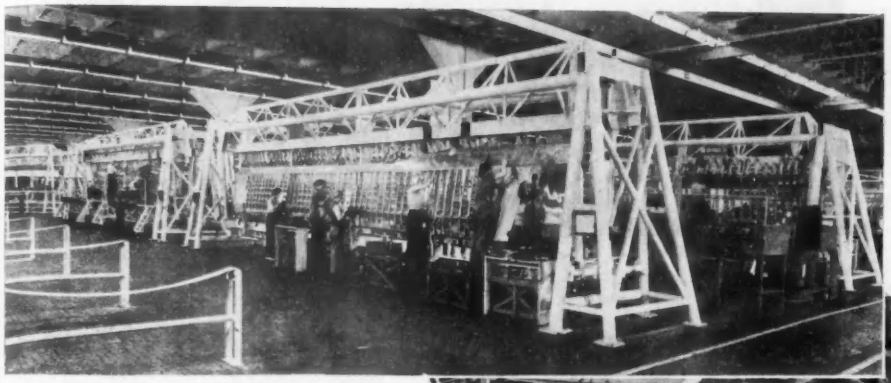
The 4½-degree dihedral angle of the wing, the seven-degree sweep-back and the large vertical fin, make the airplane very stable, both in direction and in roll, suppressing any tendency to slip or skid. Any tendency to fall off on one wing during a stall is immediately converted into a bank and then into a glide, straight ahead.

Control surfaces were developed that require no hydraulic boost of flight controls. The result is a simpler, less expensive, less vulnerable, and more easily maintained control system. Ailerons have combination servo tabs and



Constructing a B-29 fin at the Goodyear Aircraft Corp. plant.

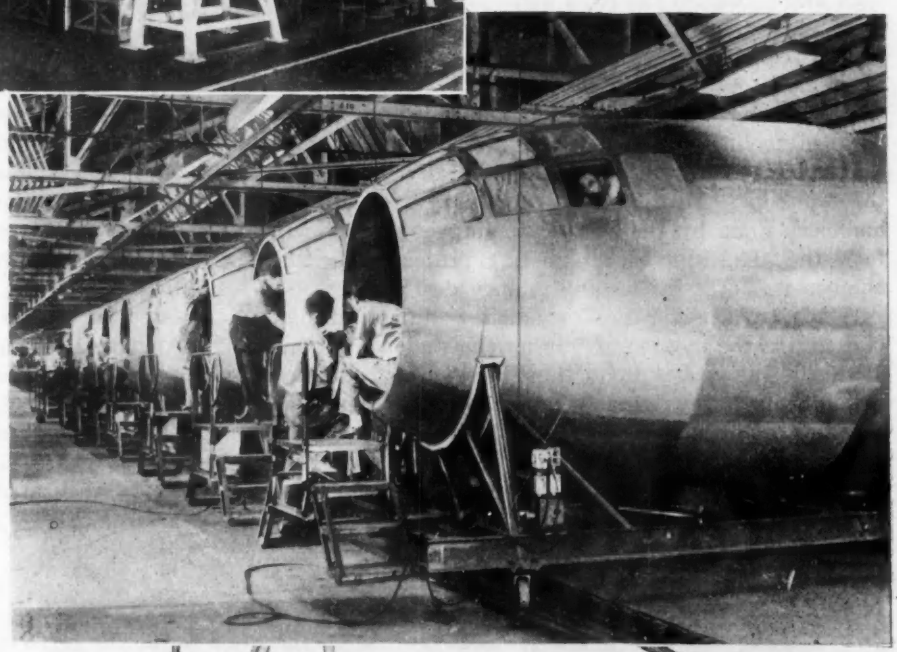
Design Features



(Left) Giant fixtures are necessary for assembling the B-29 wing flaps. This view shows that department at Fisher's No. 2 plant in Cleveland.

•

(Below) Nose sections going down the assembly line at the Chrysler De Soto plant.

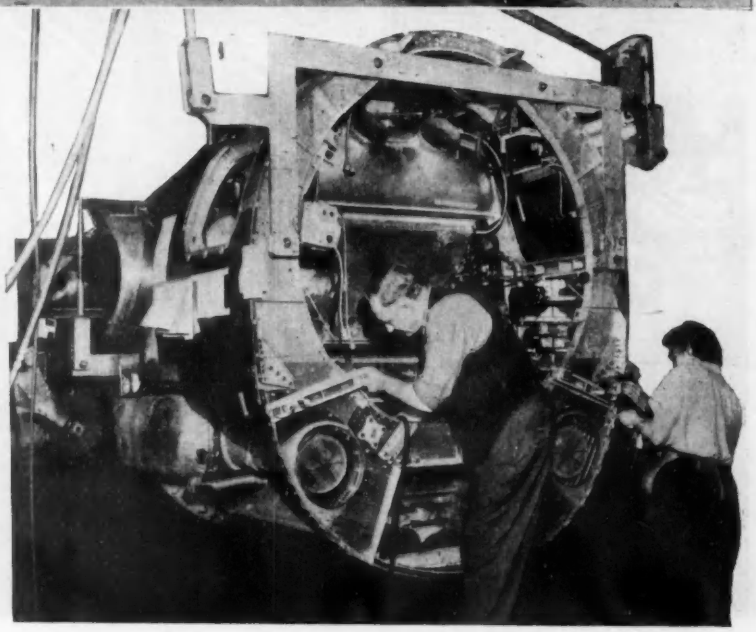


trim tabs.

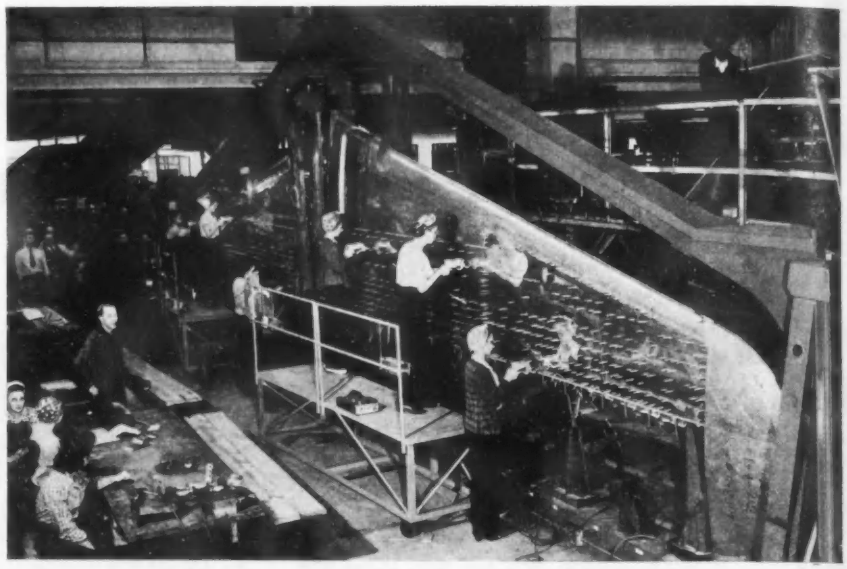
The stabilizers and elevators are identical in planform and size to those used on the present B-17's, although of different airfoil and construction. To prevent stalling the stabilizer at a critical flight attitude, the stabilizer airfoil is modified so that the leading edge is turned up, giving the effect of an inverted airfoil. A large stationary vertical tail surface and dorsal fin are used to provide directional and lateral stability even under the extremely adverse condition of two-engine failures on the same side at take-off.

The nacelle is large enough to accommodate dual turbo superchargers and intercoolers. It also provides adequate space in which to retract the landing gear, and at the same time endeavors to provide reasonable accessibility to the nacelle. One large duct in the nacelle nose eliminates a multiplicity of air inlets in the wings.

The B-29 is equipped with a "tricycle"



An engine nacelle nearing the end of the assembly line at Fisher Body's Cleveland Aircraft Plant No. 1, from where it will be shipped to a B-29 assembly plant.



Goodyear workers performing final assembly operations on a Superfortress stabilizer.

landing gear. The dual nose wheel is three ft diameter, the main wheels with dual tires, four ft eight in. diameter.

Throughout the original design process, the B-29 was engineered with a view to facilitating rapid, quantity production. Tooling engineers, meanwhile, were planning the factory equipment that would make possible such production. The fuselage was broken down into five sections for major assembly. The tooling problem was to so design and construct the tools and jigs that fabrication and assembly could be handled by the unskilled workers available.

The Boeing Wichita Division undertook the job of detailed tooling for B-29 production at its plant in September, 1941, while the Renton Division began this work in August, 1942. Preliminary work already had been done by the Seattle tooling engineers. In fact, they had started the tooling project while the bomber was still in the preliminary design stage.

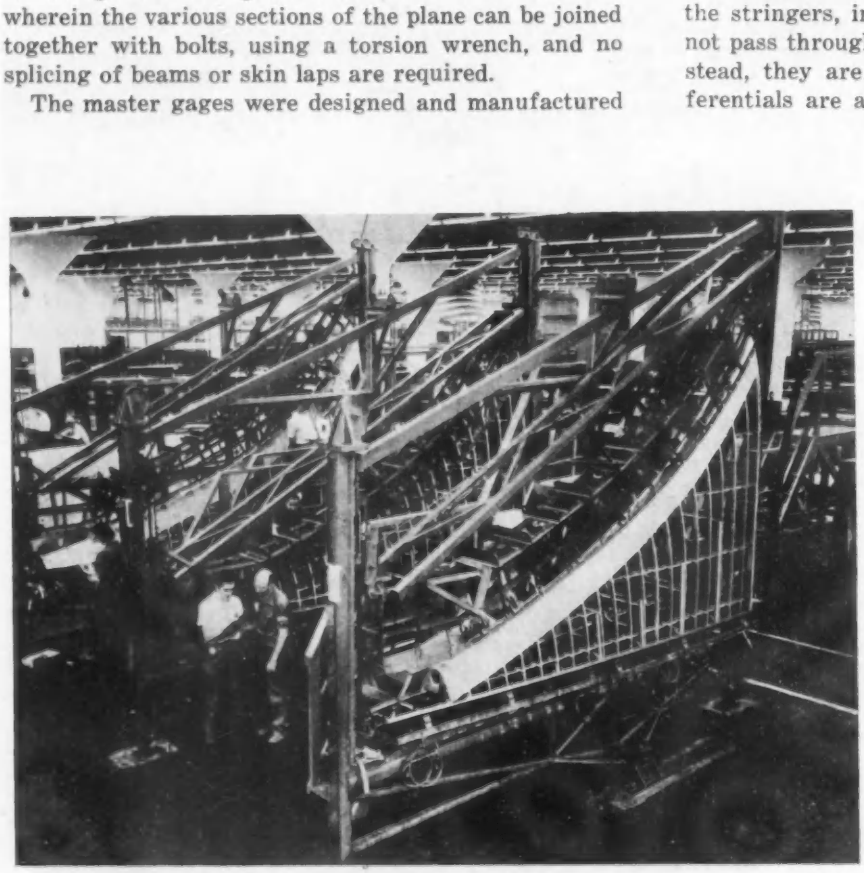
A major consideration of tooling during design phases was the method of joining the various sections of the plane. A "production joint" was obtained wherein the various sections of the plane can be joined together with bolts, using a torsion wrench, and no splicing of beams or skin laps are required.

The master gages were designed and manufactured by Boeing for all B-29 work, so as to maintain interchangeability of all major parts, no matter where built. These master gages were used in Wichita to set the jigs manufactured there.

Boeing-Seattle also designed and manufactured the major jigs for the wing and fuselage sections. These designs set the trend for Boeing-Wichita to follow in manufacturing other jigs. Tube lighting fixtures are built into the jigs, with convenient electrical and compressed air outlets provided.

Among the many evidences of "design for production" are the clips which tie the circumferentials to the stringers, inside the fuselage skin. Stringers do not pass through slots cut in the circumferentials; instead, they are riveted to the skin and the circumferentials are attached to the stringers by means of clips. Planning narrowed down the number of clip designs required in the plane to six, three left hand and three right hand.

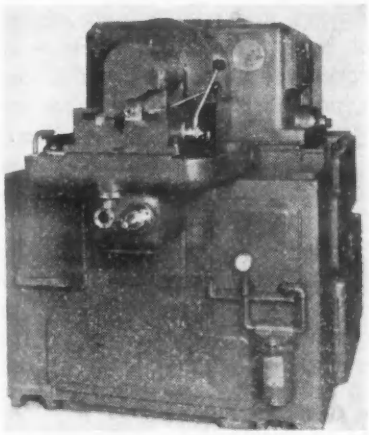
A major test of the complete airplane frame was the drop test. The Army stipulated that the plane must withstand a free drop of 27 in. The big bomber, with weight inside to simulate full equipment, bomb, fuel, crew and ammunition load, was raised 27 inches from the floor and then dropped. The Superfortress went through two of these drops, one in a horizontal position and one in an inclined position.



Row of dorsal fin assembly jigs at the Fisher plant.

New Production Equipment

THE Fellows Gear Shaper Company, Springfield, Vt., has recently placed on the market a new machine for shaving internal spur and helical gears. This machine operates on what is known as the "parallel axes" method, in that the shaving tool and work are held with their axes parallel to each other when the tool is operating. A rotary type of shaving tool is employed. This is held on a rigidly mounted spin-



Fellows gear-shaving machine

dle which is reciprocated at comparatively high speed. The work is held in a fixture mounted on an adjustable knee, which is operated by a depth feed cam for bringing the work into contact with the tool under pressure.

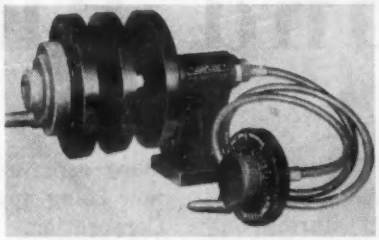
The desired shaving action is obtained by proportioning the rotation of the tool and its reciprocation so that the tool "skids" on the tooth profile of the work, thus effecting the desired shearing action. The machine is provided with complete electrical control and is operated by push buttons.

FEATURING simplified remote control and universal mounting, a variable-speed transmission has been developed by the American Pulley Company, Philadelphia, Pa., for drives up to 1 hp.

Remote control is through a flexible shaft which makes it possible to mount the unit anywhere in or on the machine and to place the control in a location handy to the operator.

Because the movement of the flanges is controlled mechanically and not by belt-pull, the Speed-Jack may be mounted either vertically, horizontally or in any other position best suited to the equipment.

The American Speed-Jack utilizes V belts to provide stepless control of



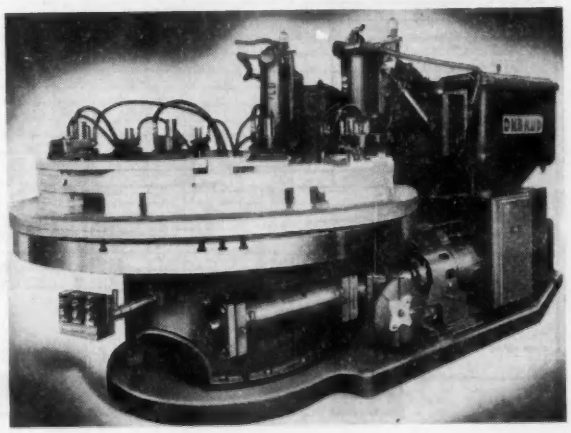
American Speed-Jack

speed through a 3 to 1 ratio. The design of the control mechanism is said to eliminate ratio-creep and to assure constant belt alignment regardless of the unit's mounted position, belt wear or belt stretch.

THE Onsrud WB-112 is the largest and newest of the automatic shaper line of the Onsrud Machine Works, Chicago, Ill. Each cutter spindle of the WB-112 rotates at 7,200 rpm. under direct drive of a 12½ hp., 3 phase, 120 cycle electric motor. The entire cutter head assembly tilts in one plane to either side of vertical up to a maximum of 10 deg. The tilt of the head is controlled automatically and varied by the use of special templates or pattern setups.

The ram type cutter arms of the WB-112 each have a maximum travel of 22 in. on the table radius line. The machine may therefore be set to reach any point 12 in. from the table center to 14 in. beyond the table edge.

Work is clamped to the rotating table of the WB-112 by pneumatic clamps controlled by an automatic safety switch. Rates of feed obtainable with the 84-in. diameter table range from .2 to 2.0 rpm. Table feed drive consists of a 2 hp. General Electric Thymotrol unit with 2 hp. direct current gear motor. Turning capacity of the WB-112 is 112 in. It handles work up to 112 in. in diameter, 79 in. square or 97 in. long.

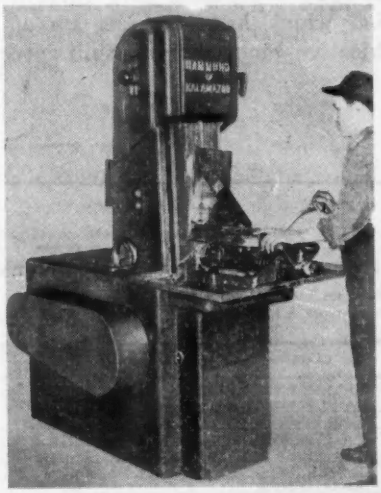


Onsrud WB-112 shaper

THE Plan-O-Mill Corporation, Hazel Park, Mich., is making a line of carbide insert thread milling cutters in National, Whitworth, Acme, V, and special forms, ground or unground, with straight or spiral flutes, with or without provision for the Higbee cut. Both shank and shell type cutters are offered.

Among the advantages claimed for the new line of carbide insert cutters are faster cutting, exceptional finish and accuracy, and longer tool life.

A 10-IN. Wet-N-Dri abrasive belt grinder is a recent development of Hammond Machinery Builders, Kalamazoo, Mich. This new Wet-N-Dri grinder carries up to a 10-in. abrasive belt and weighs over a ton. The machine is now equipped as standard with either of two types of tables, oscillat-



Hammond 10-in. abrasive belt grinder

ing or plain, determined by the class of work being handled. The oscillating table has a micrometer stop graduated in .001 in. for accurately controlling depth of grind, and has three "T" slots for attaching fixtures. It has a single handle for both feeding and oscillating the work.

A large capacity coolant tank unit is located in the base of the machine and adequate controls are provided for wet

(*Turn to page 92, please*)

A Modern Application of

Cost and Budgetary

BEGINNING some three years ago, the Vultee Field Division of the Consolidated Vultee Aircraft Corp. (then Vultee Aircraft, Inc.) started to set up the framework of a system of operating controls. The installation, of course, was made gradually over a period of time. As each step was successively completed, they came a little closer to the goal which had been set up at the beginning, an objective embracing a fully coordinated system of many separate controls. This system of controls is now being applied in all the various Divisions of the Corporation.

In attempting to cover the important points of such a broad subject, it is necessary to eliminate, so far as possible, any detailed description of methods and processes which are well-known and widely used, though, of course, this cannot be entirely avoided. It is intended, however, to cover the breadth of the subject and indicate its scope, with particular emphasis upon the correlation of the various units into one well-coordinated whole; and to make special explanation regarding those techniques which are not considered to be universal practice and those particular points which have been emphasized by the features of this particular application.

REPORT NO. VF-222-410

CONSOLIDATED VULTEE AIRCRAFT CORPORATION
VULTEE FIELD DIVISION VULTEE FIELD, CALIFORNIA

DIRECT DEPARTMENT OPERATING REPORT

DEPT. NO. X
DEPT. NAME A Fabrication Department

PERIOD February
WEEK 4
W E 2-27-44

CLASSIFICATION	AMOUNT IN DOLLARS			PERCENT REALIZATION		
	STANDARD	ACTUAL	VARIANCE	THIS WEEK	PERIOD TO DATE	PREVIOUS PERIOD
DIRECT LABOR ON STANDARDS						
Basic Trainer	4,487	6,448	1,961	70	74	77
B24D Power Plant	1,154	1,283	129	90	91	102
Double Fin	189	335	146	56	74	81
Wing Tip	1	10	9	10	15	6
Miscellaneous						75
TOTAL	5,831	8,076	2,245	72	77	82
DIRECT LABOR NOT ON STDS						
PRODUCTIVE	696	967	271	72	77	82
TOOLING	166	230	64	72	77	82
TOTAL	862	1,197	335	72	77	82
TOTAL UTILIZED LABOR	6,693	9,273	2,580	72.2	77.0	82.1
UNUTILIZED LABOR						
TRAINING		82				
OVERTIME PREMIUM		843				
NIGHT SHIFT PREMIUM		546				
EXTRA WORK		138				
REWORK		160				
IDLE TIME		28				
RATE VARIATIONS						
TOTAL	1,294	1,797	503	72.0	77.2	81.6
INDIRECT LABOR						
SUPERVISION	1,076	1,282	206	84	82	76
CLERICAL	69	104	35	66	67	62
SWEEPERS	236	247	11	96	88	116
OTHER INDIRECT	264	366	102	72	76	82
TOTAL	1,645	1,999	354	82	82	80
INDIRECT EXPENSE						
OPERATING SUPPLIES	65	73	8	89	68	64
MAINTENANCE SUPPLIES						
PERISHABLE TOOLS						
BROKEN TOOLS	170	199	29	85	106	202
TOTAL	235	272	37	86	92	127
ASSIGNED INDIRECT LABOR						
INSPECTION	1,580	1,652	72	96	93	90
PRODUCTION CONTROL	922	954	32	97	100	96
TIMEKEEPING	106	143	37	74	82	77
MAINTENANCE	620	1,079	459	57	54	61
TOTAL	3,228	3,828	600	84	83	83
TOTAL CONTROLLABLE LABOR AND EXPENSE	13,095	17,169	4,074	76.3	79.0	82.7
AVERAGE PERCENT REALIZATION				80.8	79.9	77.5

FORM 101-93 ISSUED BY COST ACCOUNTING 3-6-44

CHART 1—All items of Direct Labor and Expense are reported weekly with a comparison of standard and Actual, in the Departmental Operating report.

The General Plan

The first step in attempting to bring costs under control is obviously to break down each large total into a sufficient number of small segments to furnish adequate control. This is accomplished by providing first, for all reports to be broken down by department; second, for a further subdivision of departmental figures. In the case of direct labor items this subdivision is achieved by the use of Cost Centers. For items of indirect expense the division is by account number. Thus the total cost of the items under consideration is broken down into many small segments, each of which is then subject to a control applied directly and individually to that single item.

In controlling direct labor items, standards set by time study are used, and in controlling expense items, standards are set up on the basis of variable budgets. Both of

y Controls

By P. B. Crouse
Industrial Engineering Supervisor,
Vultee Field Div.,
Consolidated Vultee Aircraft Corp.

CONSOLIDATED VULTEE AIRCRAFT CORPORATION — VF-221
Vultee Field Division — DEPARTMENT Z

% REALIZATION
PRODUCTIVE LABOR BY COST CENTER

TOTAL DEPARTMENT		Ave. 5 Weeks Ended 1-30-44	2-6	2-13	2-20	2-27
COST CENTER 1 Bench Work	Actual Time	1856	1504	1406	1495	1478
	Standard Time	1568	1718	1422	1769	1661
	% Realization	84	114	101	118	112
COST CENTER 2 Sawing	Actual Time	889	810	720	798	672
	Standard Time	587	560	447	626	478
	% Realization	66	69	62	78	71
COST CENTER 3 Drilling	Actual Time	828	691	690	633	676
	Standard Time	562	713	545	544	561
	% Realization	68	103	79	86	83
COST CE... Ero...	Actual Time	725	562	5...		
	Standard Ti...		44...			
					608	707
					63	72
	Actual Time	1975	1927	2069	2083	1829
	Standard Time	1313	1375	1518	1610	1489
	% Realization	67	71	73	77	81
COST CENTER 12 Hydro Press	Actual Time	453	368	369	340	269
	Standard Time	423	269	243	239	270
	% Realization	93	73	66	70	100
COST CENTER 13 Circle Shearing	Actual Time	1255	1136	1213	1286	1072
	Standard Time	811	920	815	904	799
	% Realization	65	81	67	70	75
TOTAL	Actual Time	12813	11823	11577	12021	11160
	Standard Time	8805	9436	8290	8928	9256
	% Realization	69	80	72	74	83

CHART 2—The Per Percentage of Realization report, by Cost Center, is the first use of Standards for Direct Labor and forms the basis for all Operating Control reports.

these are applied by the use of reports showing the comparison between standard and actual, as is shown by Chart 1. Summaries of the totals of all these figures are provided for the use of top management.

Direct Labor Standards

Standards are naturally divided into two general classes; those applied to direct labor and those applied to indirect expense items. Direct labor standards are established by time study and are used either directly, as in the case of assembly work, or indirectly through the medium of synthetic standard sheets, as in the case of fabrication departments. The subject of time study methods and the development of synthetic standard sheets for fabrication work is too far reaching to permit discussing here. I would simply state that at Vultee Field synthetic standards, based on thousands of time studies properly correlated, are used to cover all fabrication work in all fabricating departments and much assembly work such as riveting, drilling, spot-welding, etc.

Use of Standards

There are two major divisions into which various plans for the control of direct labor fall, those which use direct labor wage incentives and those which do not. The policy at Vultee Field is to follow the latter plan and all procedures are set up on this basis.

It is important to point out that in this plant we do not use standards to tell the operators how many pieces they must produce. This puts the use of standards on a very different basis from that to which most industrial engineers are accustomed, for most industrial engineers have used labor standards, almost exclusively, to, in effect, tell the operator how many pieces must be produced in a given time. In this application the foremen are not permitted to use the

THE USE OF CRUDE STANDARDS

	WITH CORRECT STANDARDS			WITH CRUDE STANDARDS		
	SH/PIECE	PROD.	SH/PROD.	SH/PIECE	PROD.	SH/PROD.
ASSEM. A.	10	100	1000	12	100	1200
B.	20	100	2000	25	100	2500
C.	5	100	500	4	100	400
TOTAL	35		3500	TOTAL 41		4100
	SH/SHIP		÷ 35 SH/SHIP = 100 PRODUCED	SH/SHIP		÷ 41 SH/SHIP = 100 PROD.

CHART 3—Crude Standard may be used effectively for Operating Controls where the cost of maintaining meticulously accurate standards is not warranted.

COMPARISON OF COST CENTER REPORT & HOURS PER SHIP REPORT

ASSUME:

	(A)	(B)
PROD IN EQUIV SHIPS	160	
STANDARD HRS PER SHIP	7.50	STANDARD REDUCED 20%
STANDARD HRS OF PROD.	12000	ACTUAL TIME REDUCED 20%
TOTAL ACTUAL HOURS	16000	

FIGURES OF THE COST CENTER REPORT

	(A)	(B)
STANDARD HRS. PRODUCED	12000	9600
ACTUAL HOURS	16000	12800
PERCENTAGE OF REALIZATION	75%	75%

(SHOWING NO APPARENT IMPROVEMENT)

FIGURES OF THE HRS. PER SHIP REPORT

	(A)	(B)
STANDARD HRS. PRODUCED	12000	9600
STANDARD HRS. PER SHIP	7.50	6.00
EQUIVALENT SHIPS PROD.	160	160
ACTUAL HOURS	16000	12800
ACTUAL HOURS PER SHIP	100	80

(CORRECTLY SHOWING THE 20% REDUCTION IN COST)

CHART 4—The Hours per Ship report correctly shows savings in labor hours.

standards as a club to drive any particular amount of work out of the employes. The foremen are told what the standards are, on the work involved in their department, and are given the advantage of the use of this information in dealing with the employes, but no standard is used directly for this purpose with the employe.

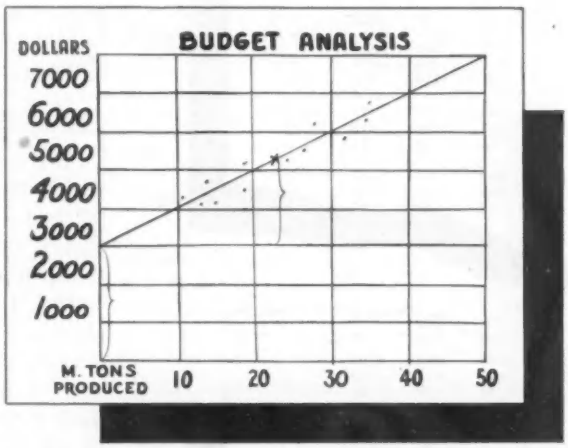


CHART 5—The slope of the Variable Budget line may be determined by analysis of past history.

Group Application

Direct labor standards may be applied in two general ways, either individually or on a group basis. In applying standards for labor control by groups, we are operating on the basis of control by exception. In control by exception, we require only a record of the total production of a cost center group and the total actual time taken by this cost center group. These figures, by cost center, indicate which cost centers are producing satisfactorily and therefore do not require attention; and which are showing unsatisfactory results and therefore are the exceptions which require immediate and concentrated attention. This eliminates the need for thousands of records of the results on individual jobs, which records would have to be analyzed by dozens of people in an attempt to determine proper remedies and in most cases the delay, which is unavoidable between the actual occurrence in the shop and the final analysis of the record, would make effective analysis very difficult. In control by exceptions very little time is required for the preparation of records and reports; the reports immediately indicate when something is going wrong in a cost center; no time is spent on these cost centers where results are satisfactory and when something does go wrong, time study men may then be sent right down to the cost center to find out at first-hand what is the cause. One or two time study men checking actual conditions can find out more in two days than several analysts could discover in many days examination of the Tabulator tapes showing individual records. By checking actual conditions, it may be discovered either that material is not being delivered properly, or tools are not being delivered properly or are in poor condition, or that employes' morale is interfering with results, or whatever the cause for the drop in production might be. With proper steps taken to correct the wrong condition, the engineers are then free to concentrate their attention on some other cost

INDIRECT STANDARD SUMMARY
(BASED ON ONE WEEK)

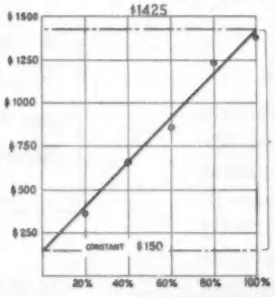
No. DEPT. X

Account No. 742

July 15, 1942

Account Name PRODUCTION CONTROL

			20%		40%		60%		80%		100%	
			HRS.		HRS.		HRS.		HRS.		HRS.	
Direct Labor Hours			5000		10000		15000		20000		25000	
Job Classification	Code #	Hrly. Rate	Emp.	$	Emp.	$	Emp.	$	Emp.	$	Emp.	$
LEADMEN	131	$1.00	1	40.00	2	80.00	3	120.00	4	160.00	5	200.00
DISPATCHER A	511	.90	–	–	1	36.00	1	36.00	2	72.00	2	72.00
" B	512	.85	2	68.00	4	136.00	4	136.00	5	170.00	6	204.00
" C	513	.80	6	192.00	9	288.00	13	416.00	18	576.00	20	640.00
DEPT. CLERK A	311	.85	1	34.00	1	34.00	1	34.00	2	68.00	2	68.00
" " B	312	.75	1	30.00	3	90.00	4	120.00	6	180.00	7	210.00
TOTAL			11	364.00	20	664.00	26	862.00	37	1226.00	42	1394.00



VARIABLE $1425
LESS $ 150 CONSTANT
1275/25M D/L HOURS

STANDARD $510/10M D/L HOURS + $150.00 CONSTANT

CONSOLIDATED VULTEE AIRCRAFT CORPORATION
SAN DIEGO DIVISION — SAN DIEGO, CALIFORNIA

CHART 6—Setting the slope of the Variable Budget line by analysis of elements.

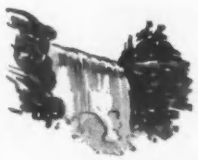
A TON OF FINISHED STEEL REQUIRES

ORE—2,800 LBS.

COAL—1,600 LBS.

LIMESTONE—825 LBS.

AIR—16,000 LBS.



WATER—480,000 LBS.

Some job to make a ton of steel

But America Makes Millions of Tons a Year

Have at hand—2,800 pounds of iron ore; 16,000 pounds of air; 480,000 pounds of water; 87,000 cubic feet of gas; 1,600 pounds of coal; 825 pounds of limestone; 4,300 pounds of steam; 1,500 pounds of steel scrap—also fluxes, alloys, refractories, electric power, sulphuric acid, muriatic acid, fuel oil, pitch . . . and furnaces capable of developing 27,000,000 B. t. u. for each ton of steel to be shipped.

Making a ton of steel is complex in method and equipment, as well as in the number, and quality of ingredients, supplies and utilities.

At Inland these complex processes are controlled by a large staff of metallurgists working in laboratories and in the plants, and by specially trained engineers who constantly investigate and design new mechanical methods and equipment. Basic ingredients—ore, limestone, coal and fluorspar—come from Inland owned mines and quarries—selected and blended to meet the needs of critical steelmakers. All other supplies are obtained under rigid specifications.

The Inland "know how" for making each ton of steel is giving America quality steels for Victory—later it will help supply the quality steels for America at peace.

INLAND STEEL COMPANY

38 S. Dearborn St., Chicago 3, Illinois

Cincinnati • Detroit • Kansas City • Milwaukee • New York • St. Louis • St. Paul

CONSOLIDATED VULTEE AIRCRAFT CORPORATION
VULTEE FIELD DIVISION

DEPARTMENT Y — INDIRECT MANUFACTURING EXPENSE — DATE Feb. 2, 1943
SUPERVISOR John Smith — VARIABLE BUDGET — FOR P.E.

CLASS OF EXPENSE	ACCOUNT NUMBER	(CHECK) LABOR	(CHECK) OTHER	BUDGET ALLOWANCE CONSTANT	BUDGET ALLOWANCE VARIABLE	BASE REFERENCE
Broken Tools			x	$ -0-	$ 17	Per M Std. $
Operating Supplies			x	-0-	192	Per M Std. $
Salaried Foremen		x		300	45	Per M Act. $
Hourly Supervision		x		-0-	32	Per M Act. $
Inspectors		x		184	19	Per M Act. $
Department Clerks		x		32	5	Per M Act. $
Production Control		x		52	45	Per M Act. $
Timekeepers		x		53	10	
Sweepers						
Laborers						
Mach. & Equip. Maintenance						
Small T						
TOTAL LABOR						
TOTAL OTHER						
TOTAL CONTROLLABLE EXPENSE						

APPROVALS — NOTES

131-64

CHART 7—Statement of approved standards for Indirect Expense Items is issued to Foremen and others concerned.

center which may indicate a need for investigation.

Cost Centers

The division of the working force into cost centers is therefore an important factor. In setting up cost centers it is almost essential that the work in one cost center should be under the supervision of one individual so that responsibility for results may be correctly assigned. This results in the work in any cost center being geographically located together as a rule for good management provides this for all work under a supervisor. In fabrication departments it is customary to set up the cost center so as to include one type of equipment though this cost center may work on many different products. In assembly departments it is customary to provide for the cost center to include work on one product or one type of production though the equipment used may differ greatly within the cost center. Even in fabrication departments it is advisable to include various types of equipment in the same cost center when the work on these various types of equipment should obviously be under one supervisor. As a rule each cost center will cover from six to 60 employes.

Records

The record of production in standard hours requires the counting of each item produced by the cost center and the multiplying of this count by the standard hours per piece. In assembly departments relatively few assemblies are produced by each cost center and in general there is some production of each one of these assemblies every week. Therefore, the production record usually takes the form of a list of all assemblies produced, on which an entry is made by the inspector each time he passes a quantity of the assembly after inspection. These figures are converted to standard hours by matching the report sheet with a standard sheet, dittoed from the same master, which shows the standard time for each item. The total for the sheet is found by cumulative multiplication with a comptometer.

In fabrication departments the number of parts

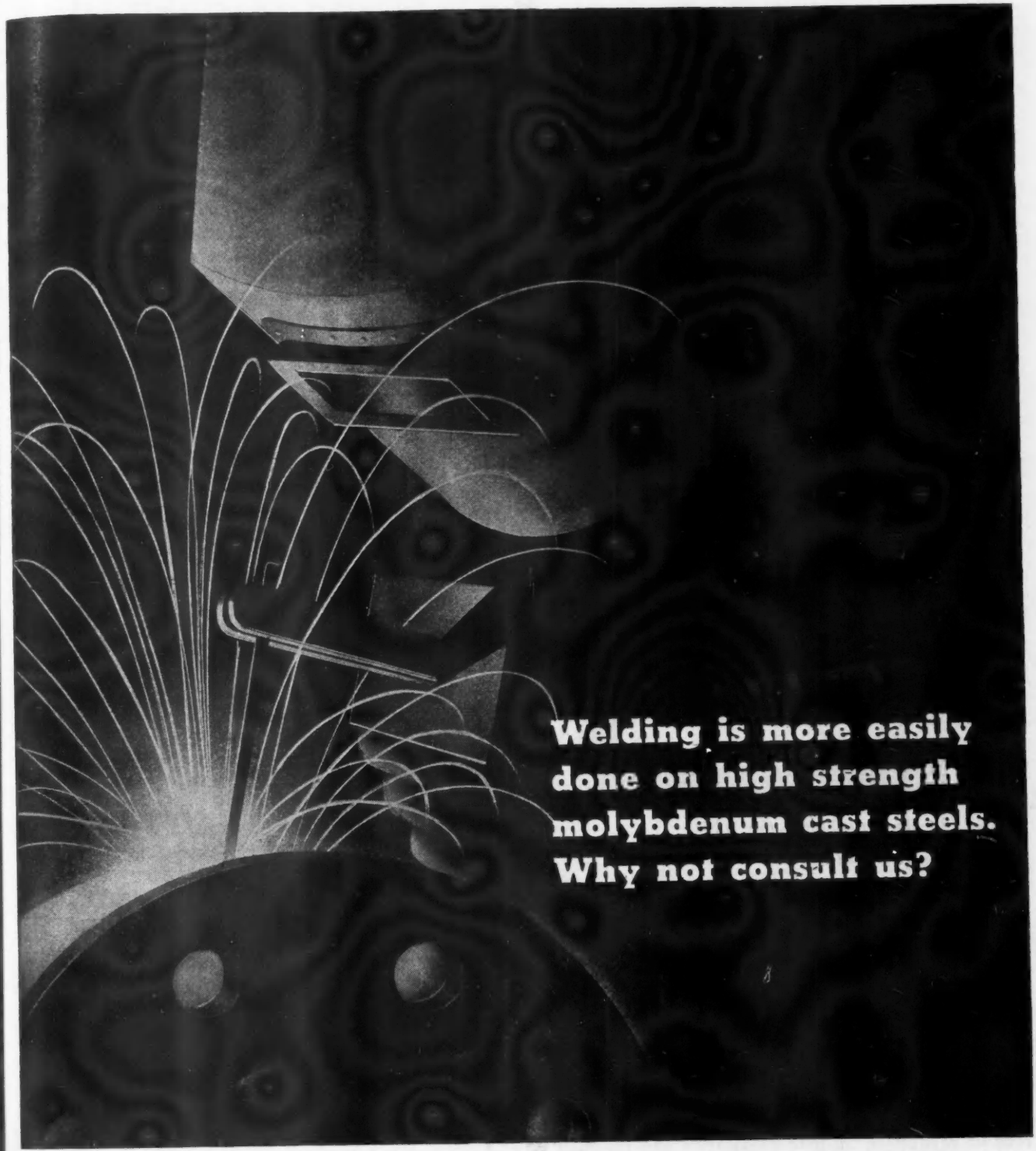
DEPARTMENT "G"

COST CONVERSION BONUS CALCULATION FOR DEC. 1942

ITEMS	% REALIZATION BOGEY	% REALIZATION ACTL.	POINT IMPVMT	BONUS FOR MAINTNG.	BONUS FOR IMPVMT	HSKPG RATING	DEDUCTN. FOR HSKPG.	SAFETY SEVERITY NOV.	SAFETY SEVERITY DEC.	SAFETY SEVERITY BONUS	SAFETY FREQUENCY NOV.	SAFETY FREQUENCY DEC.	SAFETY FREQUENCY BONUS	MEETING SCHEDULE	% TOTAL
OWN PERFORMANCE	NOV. 80%	DEC. 88%	+8	8%	4%										12.0
"THE COMPANY" PERFORMANCE	NOV. 70%	DEC. 73%	+3	5%	1.5%										6.5
HOUSEKEEPING						85	—								—
SAFETY								333	300	1%	10	8	1%		2.0
MEETING SCHEDULE														—	—

TOTAL BONUS 20.5%

CHART 8—A sample calculation for one department showing the elements entering into the Supervision Incentive plan.



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

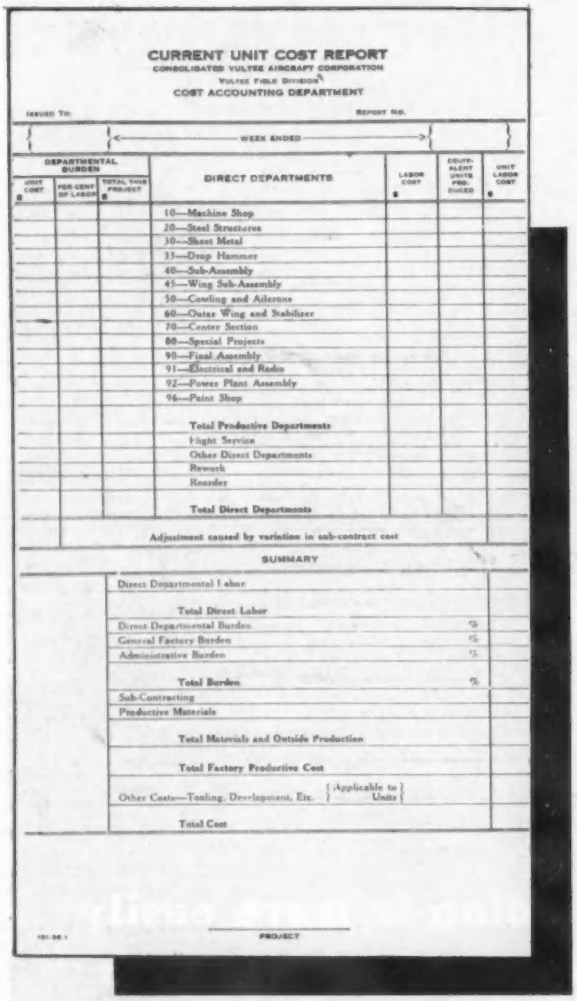
ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

MOLY

500 Fifth Avenue · New York City



CURRENT UNIT COST REPORT

CONSOLIDATED VULTEE AIRCRAFT CORPORATION

VULTEE FIELD DIVISION

COST ACCOUNTING DEPARTMENT

ISSUED TO: REPORT NO.

WEEK ENDED

DEPARTMENTAL BURDEN: UNIT COST $	DEPARTMENTAL BURDEN: PER CENT OF LABOR	DEPARTMENTAL BURDEN: TOTAL THIS PROJECT $	DIRECT DEPARTMENTS	LABOR COST $	EQUIVALENT UNITS PRODUCED	UNIT LABOR COST $
			10—Machine Shop			
			20—Steel Structures			
			30—Sheet Metal			
			35—Drop Hammer			
			40—Sub-Assembly			
			45—Wing Sub-Assembly			
			50—Cowling and Ailerons			
			60—Outer Wing and Stabilizer			
			70—Center Section			
			80—Special Projects			
			90—Final Assembly			
			91—Electrical and Radio			
			92—Power Plant Assembly			
			96—Paint Shop			
			Total Productive Departments			
			Flight Service			
			Other Direct Departments			
			Rework			
			Reorder			
			Total Direct Departments			
			Adjustment caused by variation in sub-contract cost			

SUMMARY

Direct Departmental Labor		
Total Direct Labor		
Direct Departmental Burden	%	
General Factory Burden	%	
Administrative Burden	%	
Total Burden	%	
Sub-Contracting		
Productive Materials		
Total Materials and Outside Production		
Total Factory Productive Cost		
Other Costs—Tooling, Development, Etc. (Applicable to Units)		
Total Cost		

PROJECT

CHART 9—Standards form the basic measurement used in the reporting of current unit costs.

produced by the cost center is much greater. In any one week the cost center may produce only a few of the various parts which they produce. There is also the requirement that the work be dispatched to certain machines. For this reason the production system calls for the use of work dispatch cards in fabrication departments and these cards form the basis of the record of production. The important point is that the record of standards used for the pricing of these records of production, in both fabrication and assembly departments, be so maintained as to provide an accurate total of the standards in use for a current ship at any time, for most of the control records depend upon the accuracy of this totalling of the standards for all parts in a current ship. In the use of standards for the calculation of only a percentage of realization in the cost center this element would not enter into the picture but the percentage of realization is only the first step in the use of standards. Where the other applications are concerned, it is essential that the list of all parts or assemblies involved be accurate and that the figure of total standard hours per ship coincide with the total of standards actually being used.

Cost Center Report

The Report of the Percentage of Realization of productive labor by cost center may perhaps be considered as the first use of direct labor standards. This report (Chart 2) records the standard and actual time and the percentage of realization for each cost center within a department over a series of weeks. It may be most effectively used by comparing for each cost center the percentage of realization shown for the current week with the same figure in previous weeks. Standard time and actual time are both shown so that the basic cause for changes in the percentage of realization may be quickly determined.

The Use of Crude Standards

It is, of course, desirable that standards should be as accurate as possible within reason. It is more important to have standards of some sort on every part involved than to have extremely accurate standards on a part of the production and none at all on the rest. The reason for this is that without a figure to use for total standards per ship it is impossible to prepare the control figures. To make this point clear we will refer to Chart 3. In the first case we assume that standards are very carefully and accurately set, and we assume that the production of this cost center is composed of items on which we have standards of 10 hours, 20 hours, and 5 hours per piece respectively. Let us assume that 100 of each of these pieces are produced. The standard hours of production will total 3500 hours as shown on the chart. The total standard hours per ship will be 35 hours. Dividing the total standard hours of production by the standard hours per ship, we get the figure of 100 equivalent ships produced. Now referring to case No. 2 we assume that standards have been set on a relatively crude basis, being 12 hours, 24 hours and 4 hours respectively on parts *a*, *b*, and *c* (instead of 10, 20, and 5 hours as would have been correct) and totaling to 41 standard hours per ship. Again assume a production of 100 pieces of each part. The standard hours of work produced adds up to 4100 hours as shown. Dividing this by the total of 41 standard hours per ship, we again get 100 equivalent ships produced; exactly the same figure that we would have gotten had our standards been accurately set as in the first illustration. It is recognized, of course, that for the purpose of machine loading these relatively inaccurate standards would not be as valuable as accurately set standards, but for most of the general control records, which are based on production of equivalent ships, the figures based on crude standards are just as usable. Obviously they are far more valuable than no figure at all.

The Hours Per Ship Report

The figure of hours per ship by department is calculated from total standard hours per ship by department through use of the figure of average department percentage realization. This figure of cost in hours, therefore, is an actual cost figure which is not affected by the relative tightness or looseness of standards or by changes in standards. This figure is issued in a

(*Turn to page* 114, *please*)

YOU CAN MAKE *Any Type of* GASKET LEAKPROOF

¼ Pint Can with brush
1 Pint Can with brush
1 Gallon Pail

Whatever the type of gasket . . . steel, copper, paper, composition, cork . . . Aviation Form-A-Gasket *prevents:*

Loss of Compression
Water Seepage
Corrosion
Head Seizure

Very easy to apply. Self-levelling. Sets into position. Will not run . . . even above 400° Fahr. Disassembles readily without injury to gaskets or delicate parts.

Aviation Form-A-Gasket is a liquid that is applied with a brush and changes in a few minutes to a paste. It produces a non-drying, elastic, adhesive, heat-resisting seal that is leakproof to fuels, lubricants and other liquids used in aeroplane and automobile motors.

PERMATEX Company, Inc.,

BROOKLYN 29 **NEW YORK, U. S. A.**

Truck Problems

Analyzed at SAE National T&M Meeting

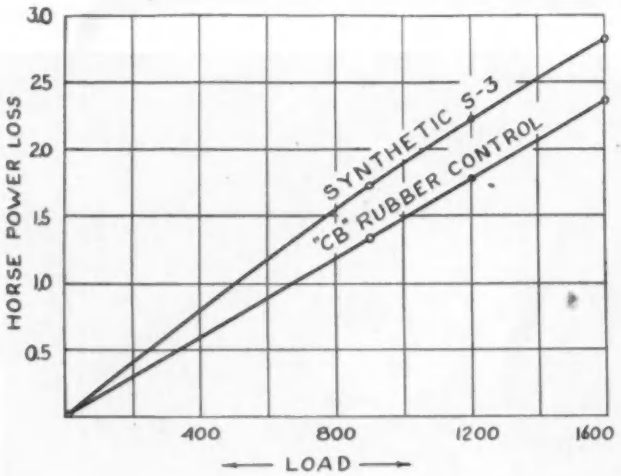


Fig. 1—Horsepower loss for rubber and synthetic rubber 6.00-16 (4 ply) tires at various loads. The speed is 30 mph and inflation pressure 28 lb.

POSTWAR trucks, engine sludge, cooling system problems and tires were chief topics at the SAE National Transportation & Maintenance Meeting June 28-29 at Philadelphia, where close to 500 fleet operators and automotive engineers assembled at one of the largest T & M events sponsored by the Society of Automotive Engineers. At the general meeting Col. John Andrews, of the National Headquarters of the Selective Service System, explained what is being done to recondition servicemen for re-employment. SAE President W. S. James addressed the meeting on the postwar possibilities of the T & M Activity.

The first technical session was devoted to postwar trucks, the paper on that subject being read by B. B. Bachman, vice president in charge of engineering, The Autocar Co. The first part of it was a reply to the paper, "What Do Fleet Operators Want in Postwar Trucks," which was presented by G. W. Laurie at a recent SAE meeting, and in the second part developments being contemplated by truck manufacturers were discussed by the Autocar official. He foresees no sudden change in the design of trucks, regardless of how the passenger car development goes. For the most part Mr. Bachman presented a broad discussion of the various units of the truck and considered them in the light of changing trends rather than actual accomplishments.

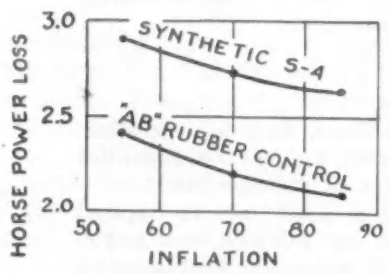


Fig. 2—Horsepower loss for rubber and synthetic rubber 7.00-20 (10 ply) tires at various inflation pressures. The load on each tire is 2250 lb at 30 mph.

In commenting on the suggestion that 130 bmep and 3000 rpm are the maximum figures for truck engines, he pointed out that they are not too far beyond the capacity of materials and design limits, although as yet they have not been completely demonstrated as practicable. Mr. Bachman believes the engines that will produce this performance first will probably be in the smaller sizes, but that for engines of 500 cu. in. displacement and over, the speed will be scaled down and it will be found more difficult to develop the pressure and still have smooth operation.

Fast rear axle ratios are desirable and if they come into use, he stated, single reduction gears may be used more in the larger vehicles, in which case the use of hypoid gears can be expected.

According to tests made at the Firestone Tire & Rubber Co. on the Sprague machine, there is a higher horsepower loss with synthetic rubber tires than with natural rubber tires under the same operating conditions, which is shown in Fig. 1 for variations in load. Fig. 2 shows the power losses at various inflation pressures. These data were given by J. E. Hale, Firestone engineer, when he discussed phases of the current rubber and tire situation, including production facilities and rates, tire construction and reconditioning. He predicted that with three or four years more and an opportunity to work on technical developments, rubber company chemists and engineers will be able to produce synthetic rubber tires of even better qualities and characteristics than have been built into natural rubber tires.

Recommending that automotive cooling systems be designed and constructed for ease of maintenance as well as satisfactory operation, D. H. Green, National Carbon Co. engineer, in his paper listed an analysis of failures, which he said may by considered as normal and indicate neglect of certain essential items of maintenance directly affecting cooling system operation, indirectly affecting performance as well as cost of operation and maintenance of the power plant. The table of causes of failures and their relation in percentages is given on this page. He proposed that the top tank of the radiator be redesigned to improve coolant visibility, with the possible addition of a petcock on the side of it to facilitate coolant

(*Turn to page* 70, *please*)

Analyses of Cooling System Failures

Number of failures investigated.	1616
Passenger vehicles	1485
Commercial and industrial vehicles	131
Number of service engineers reporting	25

Contributing Conditions	Per Cent of Total
Clogging	14.3
Corrosion damage	4.0
Thermostat failure	2.4
Combustion gas leakage	12.5
Internal coolant leakage	4.2
Cracked cylinder head or block	3.6
External leakage—	
water jacket joints	4.1
radiator and heater	8.1
water pump shaft	6.2
hose and hose connections	6.8
Insufficient anti-freeze protection	8.7
Inaccurate anti-freeze testers and testing	4.1
Overfilling	3.6
Low coolant level	4.0
Air suction into system	3.9
Thermal surge and pumping over	1.3
Foaming	.7
Air trapped during filling	.5
Miscellaneous	3.5
Undetermined	3.5

How Matched Tool Steels

Reduce "downtime" and cut unit costs . . .

TOOL: Special Punch

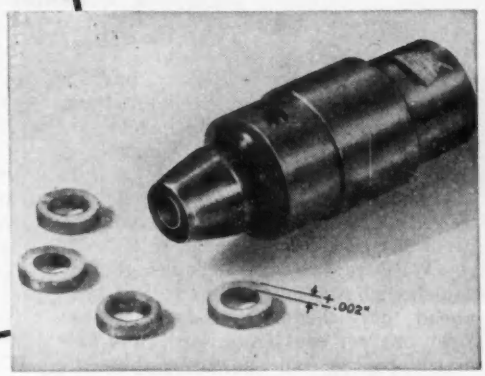
OPERATION: Punching small washer

THE PROBLEM:

Stepping up production of a washer punched from an abrasive rubberized asbestos sheet -- still maintaining close dimensional tolerances. Shutdown for regrinding necessary after only 17,000 pieces.

THE MATCHED SET SOLUTION:

By use of Carpenter Hampden (Oil-Wear) in place of a high carbon water-hardening tool steel, production time between regrinds tripled; production increased from 17,000 pieces to over 60,000 pieces per grind. Three hours tool regrind time saved daily.



● Whenever a machine or press must be stopped—output stops—and unit costs go up. The more "downtime" the higher those unit costs go.

Excessive "downtime" is often directly traceable to tools that require too frequent maintenance attention—regrinding, repairing or replacement. The example cited above indicates the benefits when "downtime" is reduced.

Many a man responsible for tools has made the discovery that much tool-caused "downtime" is unnecessary and can be eliminated—with the help of Carpenter Matched Tool Steels.

1. Because these 9 Tool Steels simplify selection—and help you get the right tool steel for maximum service on each job.
2. Because complete and easy to use heat treating instructions are furnished for each steel to safeguard hardening results and step up tool performance.

These advantages make Carpenter Matched Tool Steels easier to use in the tool rooms—and assure tools and dies that stay on the job—work more consecutive hours with less maintenance. The result is higher machine output and lower unit costs.

Carpenter Matched Tool Steels are available from conveniently located warehouse stocks. A 168-page manual provides a handy, convenient way to find the right steel for each job and supplies full and complete information on analysis, physicals, working properties and heat treatment. This manual is available from your Carpenter representative. Ask him for a copy—or write us on your company letterhead, giving position or title, please.

The Carpenter Steel Co., 103 W. Bern St., Reading, Pa.

Carpenter
MATCHED
TOOL STEELS

Heavy Military Truck Output Still Lags Behind Schedule

Aircraft Production in June Was Lowest in Ten Months with Only 8049 Planes Delivered

The War Production Board has accelerated heavy-heavy (2½ tons and up) military truck production by assigning to this important program a new high priority rating claculated to step up output that has lagged consistently for the past six months. Figure released for the month of May by the WPB reveal that although combat vehicles as a whole were two per cent ahead of schedule, production was down one per cent from April, due primarily to the bad showing on heavy-heavy trucks, which declined three per cent from April and were three per cent behind schedule. Trucks of 2½ tons and under and amphibious trucks were up to schedule.

Chief bottleneck in the heavy-heavy truck program has been the shortage of malleable, gray iron, and even steel castings and forgings. The inadequate supply of these vital components is so serious that WPB late in June assigned to the No. 1 labor referral list those foundries engaged in urgent programs, and listed on ratings jointly approved by WPB and the War Manpower Commission. This action is expected to channel more workers into the industry which has seen its help siphoned away to war plants where generally higher wage levels prevail. Many foundries have been forced to employ lower caliber help, which has only complicated the military production program because in some cases a very high percentage of castings were rejected because of blow holes and other imperfections.

WPB also will give special priority assistance to the manufacturers of heavy-heavy truck components. Where delays exist or develop in delivery of such components, requests for aid will be made to the Office of Chief of Ordnance—Detroit, where they will be screened against approved schedules and then sent to the WPB Special Rating Branch. All possible expediting help will be given, contingent on concurrence with other top urgency programs which may be affected. This competition with other programs requiring the same type of components has been an important factor hampering the truck program. Two chief contenders in this category are ball bearings and axle assemblies.

With 227,000 civilian and military trucks built during the first four months of 1944, out of a quota of 865,000 set for the year, the outlook for meeting the 1944 allotment in not promising, men in the industry say.

Aircraft production in June hit a ten months low with only 8049 planes delivered, a drop of 9½ per cent from May, according to WPB. Charles E. Wilson, Executive Vice President of WPB attributed the lag in June to the fact that 3 companies producing smaller types of planes had failed to meet schedules, that 200 trainers were held up because of parts difficulties, and that May was a short work month.

Production of the new B-29 was satisfactory, with one plant ahead of schedule and other heavy bomber output also was in excess of goals. The new Douglas Co. plant at Chicago was 15 per cent ahead of schedule on C-54 cargo planes. This was offset, however, by a slump at the Curtiss-Wright Plant at Buffalo which cost 63 C-46 type cargo ships. Also one company making Navy fighters was behind its quota.

Willson stated that the slump of more than 1000 planes under the March record would be alarming "only if it continued, which it won't" or if caused "by something basic like manpower, which it isn't."

Overall production for May was up six per cent, although still one per cent under schedule. Output of 8902 planes accepted in May was 215 fewer than the record made in March, but 559 more than in April. However, total air-

(*Turn to page* 108, *please*)

Third Quarter Steel Production Exceeding Earlier Expectations

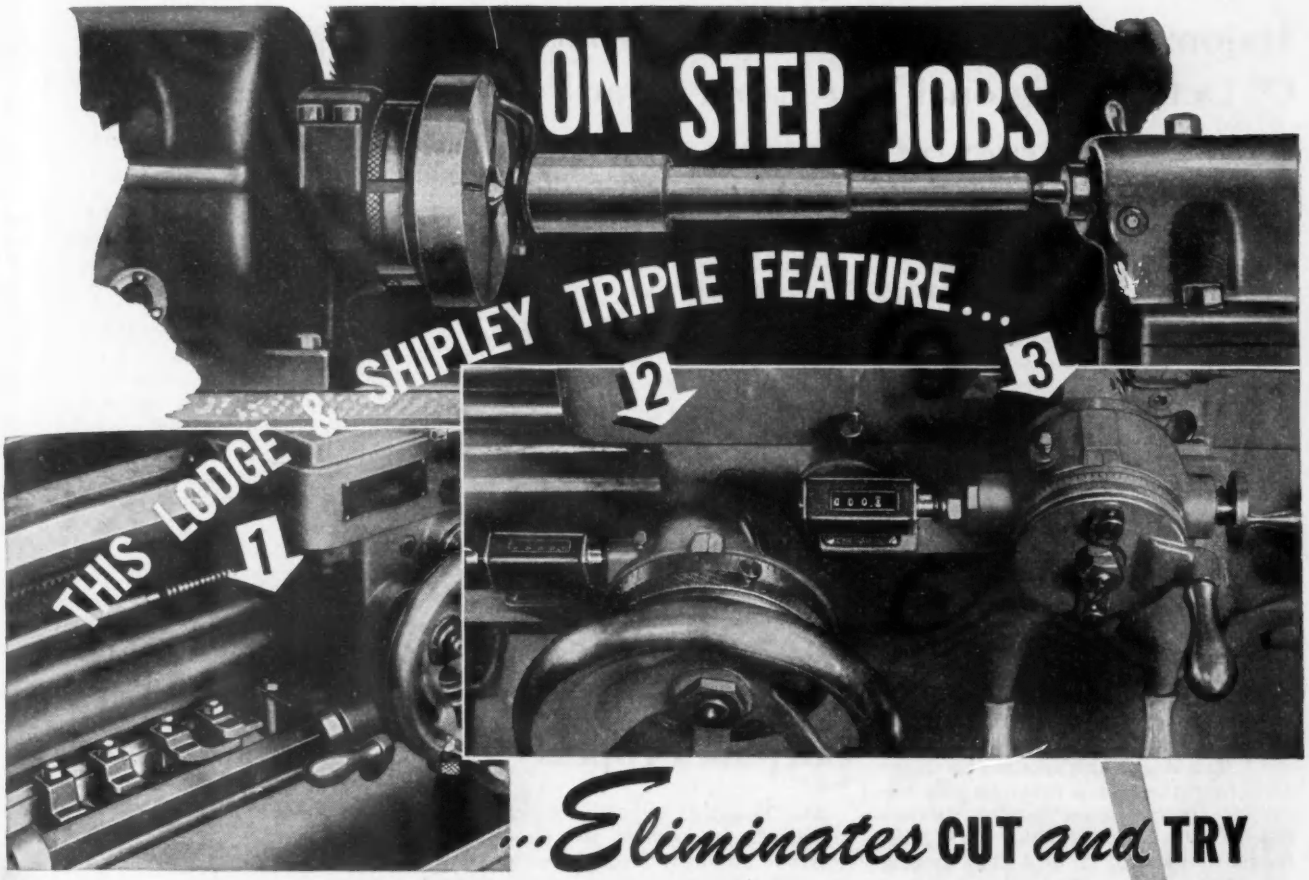
Cold Finishing Plants Have Adjusted July Schedules to Avoid Retarding the Shell Steel Program

By W. C. Hirsch

Seasonal production difficulties and those growing out of the labor shortage are being overcome better than expected in the initial period of the steel industry's third quarter. This, it had been generally predicted, would prove the year's most trying. While it is felt that possibly a new heavy tank building program may lead to modification of plate requirements for landing craft, cold-finishing plants are reported to have adjusted July schedules, so as not to retard the shell steel program, apparently of major importance in ordnance plans. Of the hot rolled sheet output in 1945, it is expected that approximately a million tons of No. 10 gage will be needed for the landing-mat program. This entails virtually no change from the current year's requirements. Rolling mills are expected to complete the 1944 quota by November, when work on the 1945 quota is to get under way without delay. Meanwhile the steel industry is watching closely developments regarding the speeding up of reconversion of the automobile plants of the country. It is well recognized in the steel industry that recommencement of civilian motor car output by utilization of 1942 models will relieve the technical staffs of steel companies of many of the problems that otherwise would have had to be faced, giving metallurgists the necessary time for preparing for an orderly return to all-out technical competition.

While there has been no definite development that would indicate amelioration of the labor difficulties in Mexico and other Latin-American copper and zinc producing countries, conditions do not appear to have worsened. Copper is still considered to be in tight supply. A group of small mine owners is importuning the Senate to probe the relatively high levels of imports of copper, tungsten; and some other metals. The Senate Small Business Committee is making an investigation. It is claimed that 4,000 smaller mines have had to shut down because OPA ceiling prices were too low. WPB Copper Division recently issued a release, emphasizing

(*Turn to page* 110, *please*)



...Eliminates CUT and TRY

MAKES SET-UPS AMAZINGLY SIMPLE

Determining the exact diameter and length of a work-piece being machined on a Lodge & Shipley Lathe is a matter of easy reading. Micrometer Dials and Counter Arrangements (Figs. 2 and 3) for either length or diameter, after being properly set, indicate when the exact dimensions desired are attained.

These Direct Reading Dials and Counters can be used with extreme accuracy and efficiency when changing from large to small diameters or the reverse—in turning, boring, facing and other lathe operations.

On lathes equipped with multiple length stops (Fig. 1), settings for step jobs can be accomplished quickly. After the first stop dog has been set, the correct settings for the balance of the stop dogs are made, using the Length Dial on the apron (Fig. 2) to determine exact shoulder positions.

The stop dogs, used in conjunction with the Dial and Counter, automatically disengage the feed at each shoulder. The apron lever (Fig. 1) when raised re-engages the feed after the tool is set for the next required diameter. In this manner, successive cuts are accurately established with minimum effort.

These and other Lodge & Shipley developments—to simplify lathe operation—permit important time savings, reduce spoilage and lower costs whether the operator is a beginner or experienced. For more complete details call on Lodge & Shipley Engineers or write on your company letterhead for booklet No. 495-B.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

L & S LATHES

ENGINE • AUTOMATIC • TOOL ROOM • OIL COUNTRY LATHES

Union Demands Go Beyond Jurisdiction Of Detroit Regional War Labor Board

Management and Labor Object to Priority Referral Plan Giving USES Control of Labor Placement

In turning down demands of seven locals of the UAW-CIO that Chrysler Corporation be required to establish postwar security benefits and a 40-hour week, the Detroit regional WLB has held that such action transcends its jurisdiction.

Specifically, the union demands included setting up of a fund from which to pay all employees unemployment compensation, guarantee of a 40-hour week, and payment by the corporation of insurance premiums and group hospitalization for all seniority employees.

It is noteworthy that in turning down the demands, WLB stated that "both the guaranteed work week and unemployment insurance look forward to conditions which will prevail in labor when the war ends, and WLB, being a war agency, cannot with propriety determine such conditions after the war." The Board also was acting under a precedent set in a previous case involving similar issues between Detroit Steel Products Co. and the UAW-CIO. In that instance, it held that setting up a postwar security fund was either a plan to decide presently what conditions would prevail in labor after the war or a proposal to raise wages of employees. Looking at it either way, the Board held further, the union's demands were not allowable since "money set aside now, but available to employees after the war is still purely a part of present compensation."

WLB also concurred in the opinion advanced by Chrysler representatives that the union demands comprise broad social policy and that Congress alone has the power to pass such legislation.

UAW-CIO officials state that the case undoubtedly will be appealed to the national WLB and that a similar case involving General Motors Corp. now is pending before that agency, which has appointed a fact-finding body. They state further that in the event the ruling there is unfavorable to the union, the issue will be carried directly to Congress or to the White House.

A significant aspect of the Chysler ruling is that the regional board did not comment on the merits of the demand, basing its denial solely on lack of jurisdiction.

That termination pay trouble is brewing between labor and management is evident from a recent study completed by the UAW-CIO. The report covers the profits made by 24 leading aircraft, parts, and engine companies before and during the war.

The study sets forth that on the basis of the industry's own figures, net sales were up 2466.3 per cent, profits before taxes jumped 1797.5 per cent, and profits after taxes increased 684.3 per cent. These figures are based on the period between 1939 and 1943, and apply to more than half the industry, but do not include such large companies as Curtiss-Wright, Wright Aeronautical, North American Aviation, and other concerns that have not as yet released figures on 1943 income. The report challenges the industry to show in view of the profits cited that it is not in condition to meet labor's demands for emergency unemployment compensation.

In rebuttal, a spokesman for the aircraft industry stated that "management is not opposed to termination pay, although it cannot help wondering what workers have done with their high wages and overtime pay. . . . . The aircraft industry knows that it is facing perilous times. Renegiation and heavy corporate taxes have left no appreciable reserves. It simply cannot meet this new demand of labor."

Meanwhile the hearing before the national WLB on the dispute between the Foremen's Association of America and seven Detroit companies and six others continues with claims and counter claims confusing the issue.

Principal grievances cited by the foremen involve pay, seniority rights, promotions, demotions, discharges, and inadequate supervisory authority. Basically, the underlying principle for which the FAA is fighting is recognition of foremen as "employees" under the National Labor Relations Act. The hearing is important in that if the panel decides that foremen, supervisors, and other supervisory workers fall into the classification of "employees" under the

(*Turn to page* 90, *please*)

Moran Heads Automotive Division, Treasury Surplus Property Disposal Organization

The Treasury Department has taken the first step toward the disposal of wartime automotive surpluses with the appointment of Lee William Moran, Pittsburgh automobile dealer, as head of the Automotive Division, Treasury Surplus Disposal Organization in charge of all surplus automotive goods. Although his appointment was not announced until June 28, Mr. Moran had already been on the job for several weeks.

In an exclusive interview with *Automotive & Aviation Industries*, Mr. Moran said that for the present, "surplus materials will be placed in the hands of dealers to relieve critical shortages in areas where they will do the most good."

Other points in the program to be used by the Automotive Division in the disposal of automotive goods are:

1. Deal with normal channels of trade.
2. As automotive parts are declared surplus they will be made available for repair of cars and trucks.
3. Get automotive surpluses off government hands and funds into the Treasury.

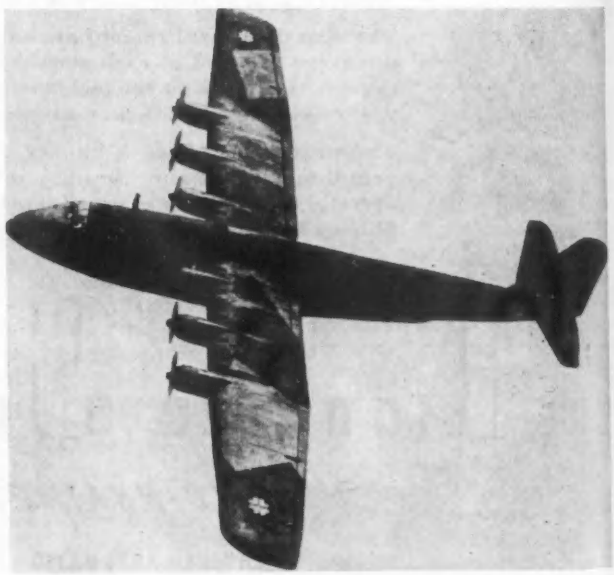
Mr. Moran said his division will handle the disposal of automobiles, trucks, combat vehicles, replacement parts, maintenance equipment, tires and all other types of automotive equipment.

He pointed out that up to the present time the only large surplus problem the

(*Turn to page* 102, *please*)

Germany's Newest and Largest Plane.

This is the BV222, built by the Blohm and Voss Company. It is 111 ft. in length and has a wing span of 138 ft. Power is supplied by six BMW 132Dc 1000 hp radial engines.



International news photo

Throughout the Industry you'll find nothing to equal

SEALED POWER LABORATORIES

Sealed Power laboratories, best-equipped in the piston ring industry, deserve a lion's share of the credit for Sealed Power leadership. In these laboratories our engineers are continuously striving for perfection in product quality and performance. Thirty years of steady improvement have made Sealed Power products favorite with major engine builders.

Let our engineers use their unequalled laboratory facilities to help make your good engines even better!

SEALED POWER CORPORATION

Muskegon, Michigan • Windsor, Ontario

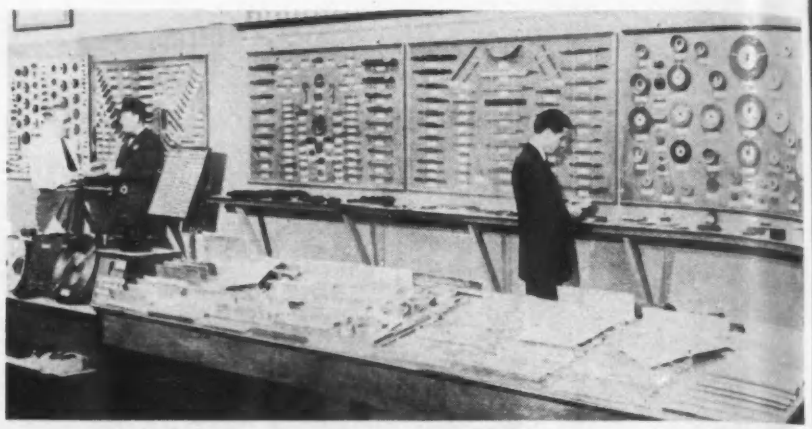
SEALED POWER PISTON RINGS

PISTONS — CYLINDER SLEEVES

Aviation "Department Store"

Aircraft parts and supplies are displayed at the American Aviation Mart, located in the Furniture Mart, Chicago. Goods sold from the sample display will be shipped from storage centers elsewhere. First company represented is Curtiss-Wright.

Acme photo



SEEING *is* BELIEVING

• Precision Springs cannot be manufactured without the help of modern precision equipment like the "Shadow-graph" below. This busy instrument in Accurate's inspection department helps Accurate engineers rigidly control spring quality. It is an example of the modern methods and practices which Accurate finds is necessary to maintain the high standards of Accurate quality and service . . . the standards you want in your spring source of supply.

SPRINGS
WIREFORMS
STAMPINGS

ACCURATE SPRING MFG. CO.
3811 West Lake Street
Chicago 24, Illinois

ARMY E NAVY

Awards

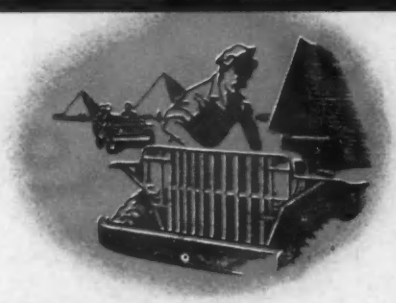
Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the July 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES went to press:

ADEL PRECISION PRODUCTS CORPORATION, Huntington Precision Products Division, Huntington, W. Va.
AMERICAN BOSCH CORPORATION, Springfield and Chicopee Plants, Springfield, Mass.
THE AVIATION CORPORATION, American Central Manufacturing Corporation, Connersville, Pa.
BURLINGTON BRASS WORKS, Burlington, Wis.
CURTIS-WRIGHT CORPORATION, Propeller Division, Indianapolis, Ind.
FORD MOTOR COMPANY, Sommerville Branch, Somerville, Mass.
GENERAL MOTORS CORPORATION, Chev-Bay City Division, Bay City, Mich.
GOODYEAR TIRE & RUBBER COMPANY, Goodyear Decatur Mills, Decatur, Ala.
JONES & LAUGHLIN STEEL CORPORATION, Otis Works, Cleveland, Ohio.
REPUBLIC GEAR COMPANY, Detroit Bevel Gear Company, Detroit, Mich.
SOUTHERN AIRCRAFT CORPORATION, Garland, Texas.
THE STEEL PRODUCTS ENGINEERING COMPANY, Springfield, Ohio.
YORK CORRUGATING COMPANY, York, Pa.

"E" Star Awards

for continued meritorius services on the production front have been awarded to the following firms:

CLARK TRUCTRACTOR DIVISION OF CLARK EQUIPMENT COMPANY, Battle Creek, Mich.
FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill.
THE H. M. HARPER COMPANY, Chicago, Ill.
INDEPENDENT PNEUMATIC TOOL COMPANY, Aurora, Ill.
McCORD RADIATOR & MFG. COMPANY, Detroit, Mich.
PLOMB TOOL COMPANY, Los Angeles, Cal.
THE SHEFFIELD CORPORATION, Dayton, Ohio.
TANTALUM DEFENSE CORPORATION, North Chicago, Ill.
WHITING CORPORATION, Harvey, Ill.

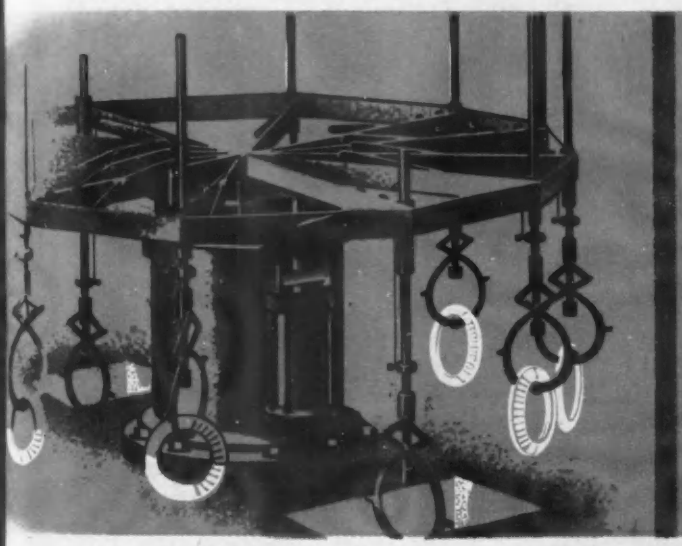


Stripcoat—the skintight "package"

Just DIP IT—SHIP IT—STRIP IT

A Complete Protective—Quickly and Simply Applied—

Handily Removed—Reduces Man-Hours by 80%



Stripcoat is a comparatively new packaging development. Formulated by Dow, this hot-melt-dip protective coating has already been tested beyond all ordinary requirements. The hazards of present-day logistics—the vast distances, the rush schedules, the unavoidable rough handling, the extreme climatic contrasts—all these have served to emphasize the efficiency of Stripcoat in actual use. Its success is due essentially to its resilient toughness, an inherent characteristic of Ethocel (Dow Ethylcellulose), the plastic base from which Stripcoat is made.

The single simple operation of dipping a metal part in molten Stripcoat provides positive protection, conserves manpower and saves time and cost, whether performed manually or mechanically. (A typical dipping machine is illustrated above.) In transit, Stripcoat resists corrosion and abrasion, and it will withstand considerable weight pressure without perforation by the metal, when parts are piled or stacked. And at destination, or following even long periods of storage, additional man-hours are saved by Stripcoat because the part can be easily hand-stripped for instant use.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW PACKAGING PRODUCTS INCLUDE—*STRIPCOAT* • *SARAN FILM* • *ETHOCEL SHEETING*

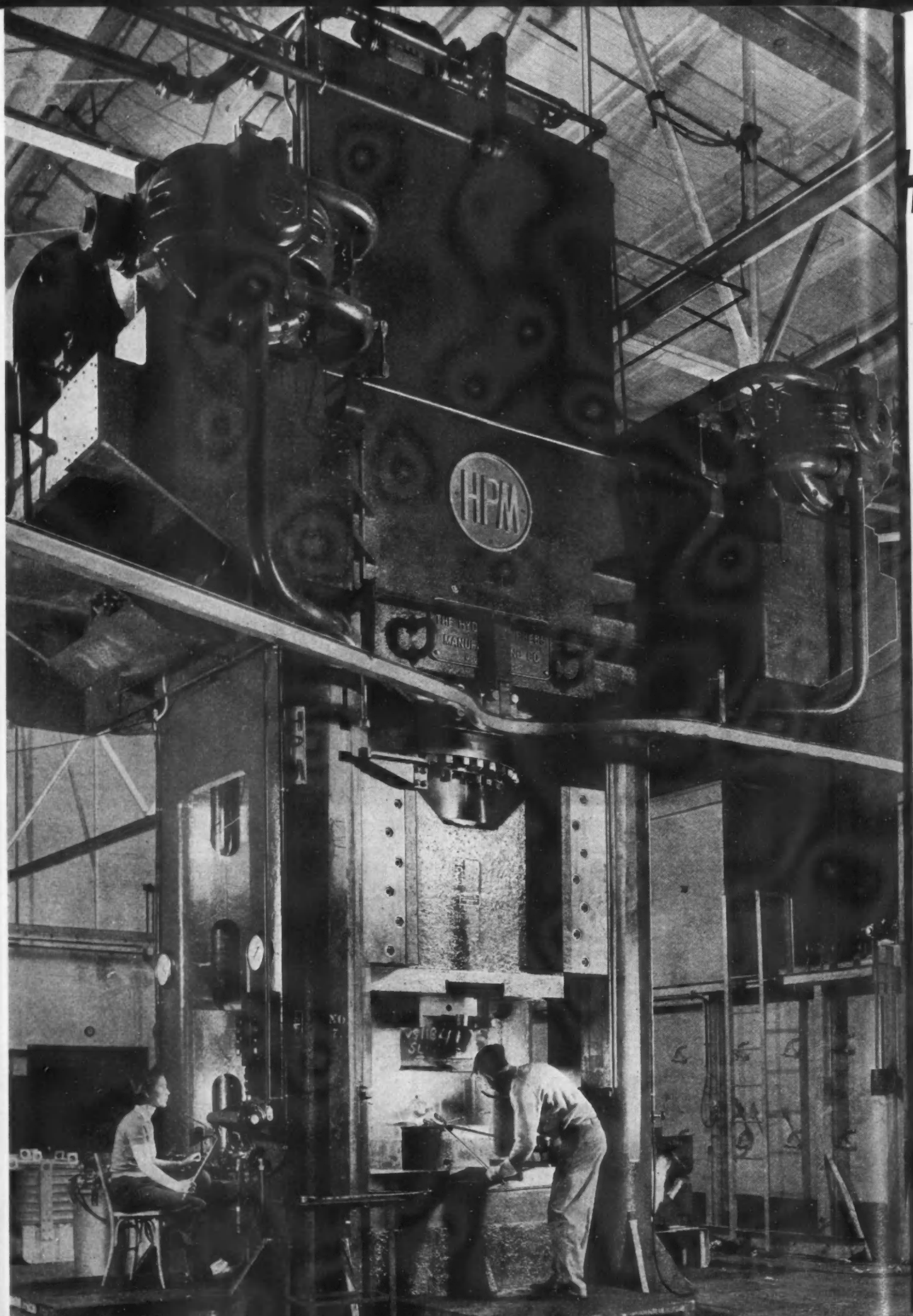
Stripcoat

DIP IT SHIP IT STRIP IT

DOW

CHEMICALS PLASTICS MAGNESIUM

INDISPENSABLE TO INDUSTRY AND VICTORY


HPM

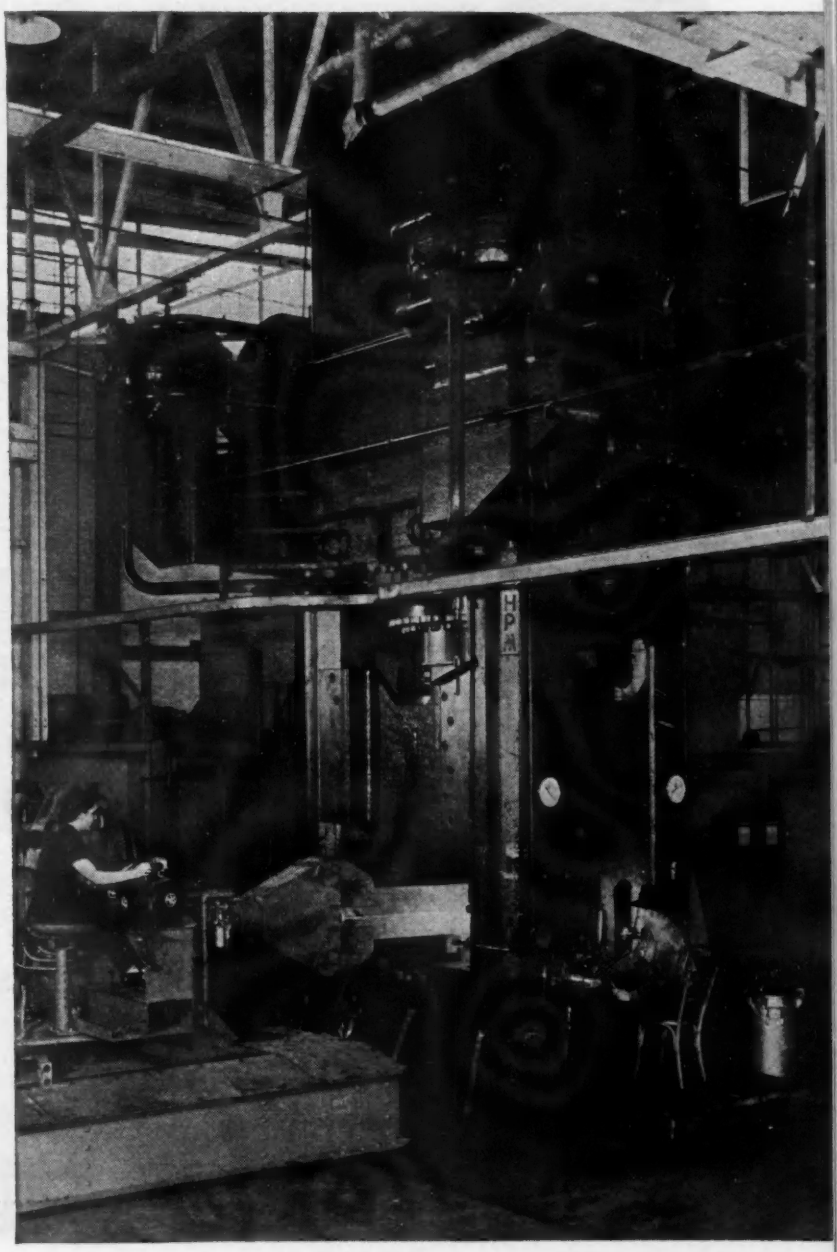
The POWERFUL SQUEEZE of the H-P-M FASTRAVERSE PRESS Has Provided Industry with its Most Diversified Forging Machine

The "All-Hydraulic" H-P-M press is revolutionizing the forging industry. The hammer is no longer the main production tool. Faster production, proper metal flow, better grain structure, longer die life and less maintenance are direct results of applying modern hydraulics to present day forging practice.

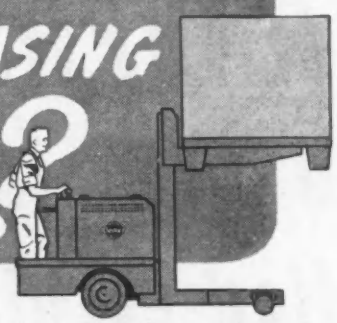
Used for both flat die and closed die forging of both ferrous and non-ferrous metals, the H-P-M "All-Hydraulic" FASTRAVERSE press is the forging industry's most diversified forging machine. Cogging, blocking and finishing operations can all be handled by the same press, regardless of whether the forging is an upset, extruded or hammer type. Send your forging drawings to H-P-M. We will gladly recommend the correct size and type of self-contained hydraulic press for your particular forging requirements. Write today.

HPM

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U. S. A.
District Sales Offices: New York, Syracuse, Detroit and Chicago. Representatives in Principal Cities.



Is Your Problem One Of Increasing Production?



If so, a Baker Material Handling Engineer can help you. Our files contain case histories of hundreds of plants which have realized their objective through an improvement in handling operations with Baker Trucks. Many of these are illustrated in the new Baker Catalog. A few typical examples are illustrated below.

★ ★ ★

One manufacturer doubled productive capacity without enlarging his plant by constructing a mezzanine floor, and substituting a Baker Crane Truck for overhead cranes removed. The truck further helped production by speeding assembly and handling operations beyond limits of craneways. *(See illustration, left.)*

An aircraft manufacturer uses a Baker Fork Truck for keeping materials and products on the move. Illustration at right shows the truck lining up crated engines for inspection, after which it loads them into box cars for shipment. Carloading with Baker Trucks can release many men for productive work. *(See illustration, right.)*

With the addition of a motor-driven winch, the Baker Hy-Lift Truck at the left, makes die-changing a simple task, enabling one operator to do the work of several in much less time. By reducing idle press time, these trucks increase the productive capacity of plant equipment. The same truck also stores the dies in space-saving racks, and serves as a conventional truck, speeding other handling operations. *(See illustration, left.)*

Baker Crane Trucks spot heavy, bulky parts into position, speeding operations on an assembly line. Crane truck at right is moving an airplane fuselage into position. The same truck also assists in installing engines and propellers, and performs other heavy duty in the plant. *(See illustration, right.)*

A large aluminum manufacturer employs women to operate Baker Fork Trucks handling press forgings and other material. This releases experienced manpower for other productive work. By reducing distance within the plant Baker Trucks make practical use of remote areas. *(See illustration, left.)*

Man and machine time can be conserved by having material at hand when and where needed. Baker Low-Lift Truck keeps machine and operator busy by bringing and removing work—at the same time keeping aisles clear, promoting plant safety. *(See illustration, right.)*

WRITE FOR YOUR COPY

Plant and production managers, traffic managers, superintendents, purchasing agents and any others concerned with material handling will find the new Baker Catalog No. 52 a valuable reference.

BAKER INDUSTRIAL TRUCK DIVISION
of The Baker-Raulang Company
2154 WEST 25th STREET • CLEVELAND, OHIO
In Canada: Railway and Power Engineering Corporation, Ltd.

Baker INDUSTRIAL TRUCKS

Business in Brief

Written by the Guaranty Trust Co. New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Narrow fluctuations of general business activity continue. The seasonally adjusted index of *The New York Times* for the week ended June 17 stood at 144.0, as compared with 144.7 for the preceding week and 141.1 a year ago.

Department store sales, as reported by the Federal Reserve Board, dropped from 152 to 135 per cent of the 1935-39 average in the week ended June 24; but the indicated value was 15 per cent above the corresponding sum in 1943. For 1944 to date, the total is 7 per cent greater than the comparable amount last year.

Railway freight loadings during the week ended June 24 totaled 881,267 cars, 0.2 per cent more than the preceding weekly number and 15.8 per cent above the corresponding figure in 1943.

Production of electric power registered an accelerated increase in the same period; and the total was 5.0 per cent above the output a year ago, as against a similar excess of 4.6 per cent reported a week earlier.

Crude oil production during the week ended June 24 again reached an all-time peak. It averaged 4,583,200 barrels daily, 14,950 barrels above the figure for the preceding week and only 2400 barrels less than the average output recommended by the Petrolelm Administration for War.

Estimated production of soft coal during the week ended June 17 was 12,300,000 net tons, 1.8 per cent less than the preceding estimate. For 1944 to date, the indicated output is 8.3 per cent above the comparable amount in 1943.

Engineering construction contracts awarded during the week ended June 29 totaled $34,447,000, as against $27,975,000 for the week before, according to *Engineering News-Record*. Contracts so far reported this year show a decline of 51 per cent from the corresponding amount in 1943—the drop in public projects amounting to 57 per cent, as against a recession of 11 per cent in private construction.

The Irving Fisher index of wholesale commodity prices advanced in the week ended June 23 to 113.0 per cent of the 1926 average, as against 112.8 a week earlier and 111.1 a year ago.

Member bank reserves declined $677,000,000 during the week ended June 28, but excess reserves rose $100,000,000 to an estimated total of $1,500,000,000. Business loans of reporting members increased $26,000,000 in the preceding week and stood $374,000,000 above the total a year ago.

Macauley Again Heads Two Automotive Groups

Confidence in the leadership of Alvan Macauley was again manifested by the automotive industry when he was re-elected president of two automotive organizations.

Mr. Macauley, who is chairman of the board of Packard Motor Car Company, was elected president of the Automotive Council for War Production for the third consecutive year.

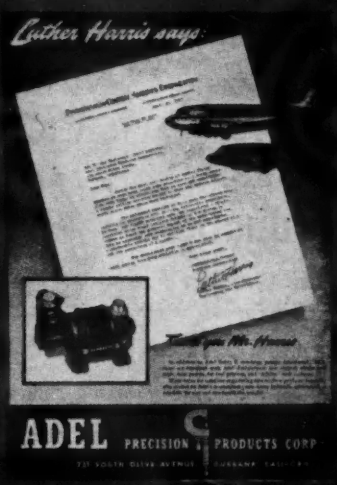
He also was asked to continue as president of the Automobile Manufacturers Association, which will be the 17th year he has served in this post.

AN 6100—1 (ANP—1 and ANP—2)
ADEL Series "K" gear type direct drive Fluid metering Pump. Weight 2.75 lb.—Cap. 2.5 to 30 GPH dual or single outlet. Tested —65° F. to +200 F. Industrial capacities to 200 GPH.

☆ *Meets . . .* AND *exceeds* AN SPECIFICATIONS

Whether for anti-icing or for heating, this pump exceeds all existing performance requirements. Test run of 1313 hours—over 8 times the requirements and still going strong! Little wonder that it received AN rating. Backed by years of service of 75,000 predecessor units starting with the original ADEL Series "E," introduced in 1938 as the *first* designed specifically for U. S. Air Lines' protection of wind shields, propellers, carburetors.

Value to cost-conscious commercial operators was long ago affirmed by Mr. Luther Harris, P. C. A. Vice-President Engineering and Maintenance (now Col. Harris, Chief of Maintenance, Air Transport Command) who praised capacity, trouble-free performance in May, 1940.



An entire ADEL division is devoted exclusively to their manfacture. Not subject to ASU allocations. Deliveries as rapid as raw materials availability. For industrial application, pumping units available without motor where mechanical drive is preferred. For complete information contact nearest engineering service office.

After Victory the ADEL-AGE

ADEL

Pioneers Affiliate With Old Timers Group

A record number of prominent motor car pioneers was elected to membership in the Automobile Old Timers, Inc., at the mid-summer meeting of the Executive Committee held on June 28th at national headquarters in the Hotel Roosevelt, New York City.

Included in the list of fifty-three new members was Robert S. Crutcher of Orlando, Fla., who at the age of 92, frequently drives his own car. Another pioneer elected was Nicholas E. Bates of West Palm Beach, Fla., who is now driving his 88th car at the age of 74. Judge William H. Hotchkiss, the pioneer's first President, was elected as Honorary President and A. B. Smith of Portland, Oregon, was elected as a member of the Board of Directors representing the Northwest.

Reports of officers presented at the meeting indicated a remarkable growth of the organization for the first six months of the year, the increase being 140 per cent greater than for the same period in 1943.

Renewal memberships during the past year established an all time record with only two months not showing 100 per cent. The membership was reported at 548, including 151 Life members and 397 Active and Charter members.

It was decided to celebrate the organization's fifth anniversary at the annual meeting to be held in New York on October 19, at which time Governor Walter E. Edge of New Jersey, an enthusiastic motor car pioneer, has been invited to be the guest speaker.

Youngren Now With Borg Warner Corp.

Harold T. Youngren, formerly chief engineer for Oldsmobile Division of General Motors, has been appointed director of engineering development for Borg Warner Corporation. Prior to his association with Oldsmobile, he had been affiliated with Allis-Chalmers, Westinghouse, Harley-Davidson, Pierce Arrow, and the Curtiss Aeroplane and Motor Corporation.

Obituary

Daniel C. Green, chairman of the board and chief executive officer of the Cleveland Pneumatic Tool Company and its subsidiary Cleveland Pneumatic Aerol, Inc., died July 2 at the Little Traverse hospital, Petoskey, Mich., after a seven weeks' illness. His death was attributed to undulant fever.

John W. Robb, 64, vice president and treasurer of the a.c.f. Motors Company died suddenly June 5 at the LeRoy Sanitarium, in New York City, after a brief illness.

Frank R. Frost, 61, president of Superior Steel Corporation, Carnegie, died June 29 after an illness of several months. Mr. Frost joined the Superior Steel Corporation in 1917 and has held the office of president since 1927.

Improved Design
ROTARY SHEAR
DOES THE WORK OF MANY MACHINES

Increases Production!
Better . . . Quicker . . . Easier
FAR LESS COST

Here, is possibly the most amazing rotary shear you have ever seen. Its revolutionary design and construction give you EXTRA features and many advantages over other type rotary shears. Remarkable for its numerous applications, it does the work of many machines—quickly and economically, when provided with the proper attachments. Does not require skilled operators. *Anyone can operate it!* Of rugged construction, with double hardened cutters and V belt drive that absorbs jolts, it shears without burrs and with *hair line* precision. Cuts mild steel up to 1 inch thick, alloy metals in proportion to hardness. Many other special features such as anti-friction, high-speed bearings, oil bath gearing, friction clutch, wear resistant alloy steel parts, result in a unit that decreases operating costs, maintenance upkeep and provides a longer over-all efficiency. Learn how. Get further details and specifications . . . . . .

KLING BROS. ENGINEERING WORKS
1314-A N. Kostner Ave., Chicago 51, Illinois

DOES ALL THIS WORK FOR YOU
1 CUTS STRAIGHT LINES
2 CUTS RINGS—SMALL OR LARGE RADII
3 CUTS CIRCLES
4 MAKES FLANGES
5 CUTS INSIDE HOLES WITHOUT CUTTING IN FROM EDGES
6 JOGGLES & OFFSETS
7 CUTS ODD SHAPES
8 BEVELS OF ANY ANGLE
9 CUTS REVERSE CURVES
10 BEADS & U'S
ALL WITH *Hairline* PRECISION

FREE!
Write today for FREE bulletin No. 245. No obligation or cost.

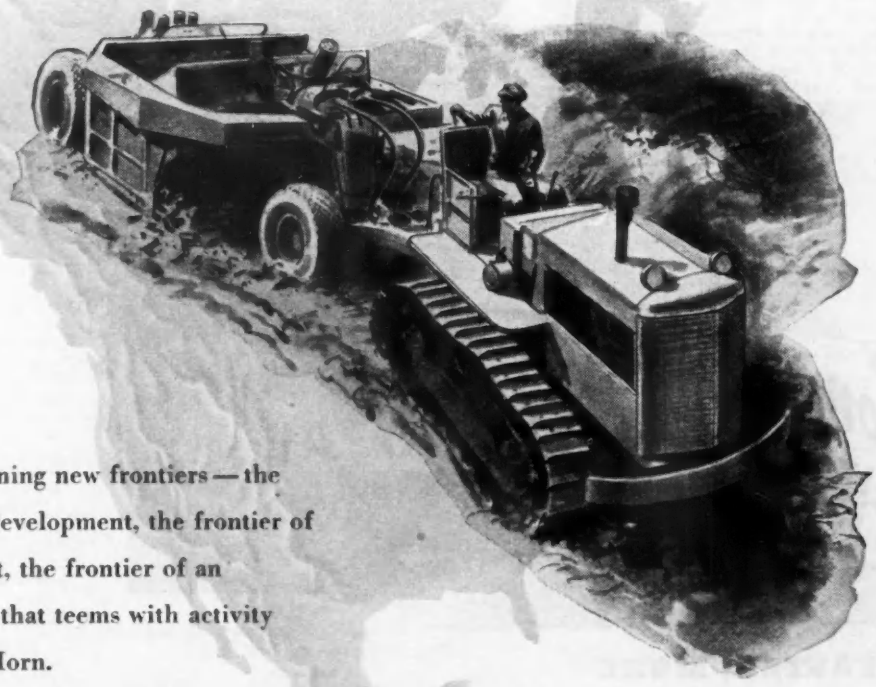
KLING ROTARY SHEARS

CALENDAR

Conventions and Meetings

SAE Natl. West Coast Transportation & Maintenance Meeting, Portland, Oregon	August 24-26
American Chemical Society, New York City	Sept. 11-15
SAE Natl. Tractor Meeting, Milwaukee	Sept. 13-15
SAE Natl. Aircraft Eng. & Production Mtg., Los Angeles	Oct. 5-7
SAE Natl. Fuels & Lubricants Mtg., Tulsa	Nov. 9-10
Motor & Equip. Wholesalers Assn. Convention, Chicago	Nov. 9-11
American Chemical Society Natl. Chemical Exp., Chicago	Nov. 15-19
SAE Natl. Air Cargo Mtg., Chicago,	Dec. 4-6
SAE Annual Meeting, Detroit	Jan. 8-12

FROM ALASKA TO CAPE HORN



Diesel engines are opening new frontiers — the frontier of industrial development, the frontier of growing military might, the frontier of an awakened hemisphere that teems with activity from Alaska to Cape Horn.

Their contribution? More flexible, more economical power where, when, and as needed. Diesels help build airports, provide power for mines, get out rubber in Brazil — do useful work everywhere.

An era of even more intensive Diesel use lies ahead — an era in which the Diesel engine builders of America will render world-wide service to transportation, industry, and commerce.

As a supplier of fuel injection equipment to engine manufacturers, American Bosch continues to provide competent maintenance service, the widest variety of equipment, and experienced counsel in application engineering.

AMERICAN BOSCH CORPORATION • SPRINGFIELD, MASSACHUSETTS

AMERICAN BOSCH

AVIATION AND AUTOMOTIVE ELECTRICAL PRODUCTS • FUEL INJECTION EQUIPMENT

PUBLICATIONS

The Cincinnati Milling Machine Co. has issued a unique catalog, M-1322, entitled **Engineering Data.** It covers the entire line of milling, broaching and cutter sharpening machines and provides the essential specifications and outline drawings for each model.*

How to Increase Production on Short-Run Turning with an Automatic Lathe is the title of a new booklet offered by the Sundstrand Machine Tool Co. Processing gear blanks and turning and boring bushings are two of the eleven shortrun jobs described. Besides facts and data, each job is illustrated with photographs and tooling sketches. Additional information includes practical tips on processing work and how to set up the Sundstrand Automatic Lathe.*

The Hydraulic Press Mfg. Co. has issued Bulletin 4404, **Plastics, the Pressure Processing of Synthetic Resins.** The bulletin is written especially for postwar planners considering plastics, who have had little or no association with the plastic industry. It describes and illustrates materials, processes and equipment for most types of plastic product production.*

A new 32-page catalog has been issued by Western Automatic Machine Screw Co. giving complete data on its set screws, stripper bolts, pipe plugs, hexagon keys and special socket screws. The catalog also contains information relative to comparative sizes and strength of screws and other handy technical data.*

Accurate Spring Mfg. Co. has issued a booklet, **Handbook of Technical Data on Springs.** It contains fundamental data, information and tables useful to design and production engineers interested in springs.*

The Industrial Oven Engineering Co. has issued a 4-page folder on its **constant-speed constant-tension windup machine** for wire, cable, rubber, tapes, fabrics and other continuous materials. The machine is completely described and illustrated.*

Bulletin 2105, **Welding Positioning Equipment,** has been issued by Ransome Machine Co. It gives information on position welding and a description of the complete Ransome line of welding positioning equipment.*

The June issue of **Lubrication,** published by The Texas Company, contains an interesting item on automotive gears.*

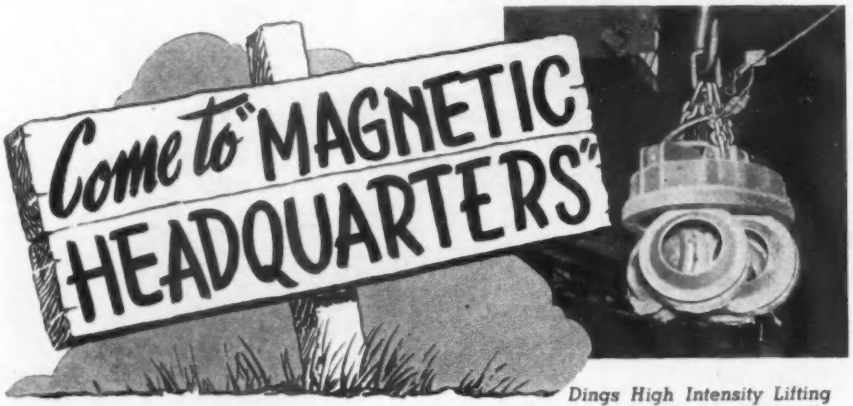
Technical Bulletin PM2 on **Geon Resins and Plastics for Calendar and Solution** processing has been issued by the Chemical Div. of The B. F. Goodrich Co.*

Technical Bulletin No. WTTC-44, giving detailed specifications, features and applications of its new combinations **timer-contactor package units,** has been issued by Weltronic Company. Complete specifications for cabinet, timers and contactors are given, together with instructions for ordering the timer-contactor units.*

Hevi-Duty Electric Co. has issued Bulletin HD-644 on **Hevi Duty Car Bottom Furnaces.** The folder contains information on the uses, construction features and design of the furnaces. Another folder, HD-744 on **Hevi Duty Convection Tempering Furnaces** has also been issued. It gives construction information and specifications.*

Minnesota Mining & Mfg. Co. has issued a new booklet on adhesives, coating materials, impregnators, spray-on insulators and sound-deadening compounds, entitled **3-M Adhesive Data.***

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.



Dings High Intensity Lifting Magnet handling five 2,000 lb. castings.

FOR FASTER, MORE EFFICIENT HANDLING OF THESE JOBS:

Separation of Ferrous and Non-Ferrous Scrap—Dings builds a complete line of magnetic pulleys, pulley type separators, drum type separators and agitating type separators for handling *all* classes of scrap.

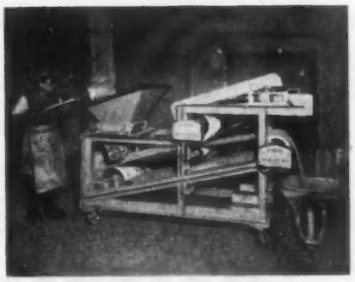
Conditioning Foundry Sand — Pulleys, pulley type separators and drums to remove all iron. Sand, hot from the shakeout floor, can be handled on Dings equipment designed to withstand high temperatures.

Reclaiming Iron from Slag — An efficient, high capacity output can be secured with Dings equipment.

Handling Metal — Scrap, castings, plates, metal flasks, pipe, etc., can be handled faster and easier with Dings Lifting Magnets.

Screwdown on Mill Stands—This and other remote control clutch jobs are naturals for Dings Magnetic Clutches.

Pulley Type Separator for removing iron from foundry sand.



Dual Pulley Type Separator with "selective separation" for non-ferrous scrap.

Write today for literature

DINGS MAGNETIC SEPARATOR CO.

539 E. Smith St. • Milwaukee, Wis.

Dings MAGNETIC SEPARATION HIGH INTENSITY

PERSONALS

Ralph A. Shelly, formerly with the Chrysler Corp. of Canada, has been appointed Replacement Sales Manager of the Manufacturers Div. of the Perfect Circle Co. He will be located at the Hagerstown, Ind., offices of the company.

John G. Farrar was elected comptroller of the General Electric Co. at a recent meeting of the board of directors.

Eisemann Corp. has announced the appointment of **Henry R. Metz** as vice-president in charge of operations and **Lloyd H. Scott** as vice-president in charge of engineering.

H. H. Fuller has been elected vice-president in charge of West Coast steel activities of Bethlehem Steel Co. Mr. Fuller succeeds **W. H. Stewart,** who is retiring.

John J. Prochaska has been appointed general sales manager of The Cleveland Automatic Machine Co., succeeding **George A. Collier,** who has resigned.

Interstate Aircraft & Engineering Corp. has announced the appointment of **L. A. Kavanagh,** formerly executive assistant to the president, Don P. Smith, as secretary of the company. **W. C. Barnett,** formerly assistant secretary-treasurer, has been named treasurer. They will assume the duties of former secretary-treasurer, **L. B. Cameron,** who recently resigned.

Henry H. Richette has been appointed manager of the contractor's tool division of the Independent Pneumatic Tool Co., with headquarters in Chicago.

The appointment of **Kenneth K. Kohnitz** as regional coach manager for Reo Motors, Inc., operating under the Philadelphia branch, has been announced.

Walter A. Clouser has joined Muskegon Piston Ring Co. as sales and service engi-

(*Turn to page* 214, *please*)

Air Power Through Piston Rings

McQUAY-NORRIS
ALTINIZED
PISTON RINGS

PISTONS...PINS...
HARDENED AND GROUND PARTS

McQuay-Norris is definitely air-minded. We are now suppliers of precision parts to the world's largest makers of aircraft motors. Our 34 years' experience in precision manufacture enables us to meet every demand of modern aviation for sturdy, unfailing precision parts. Your inquiries are invited.

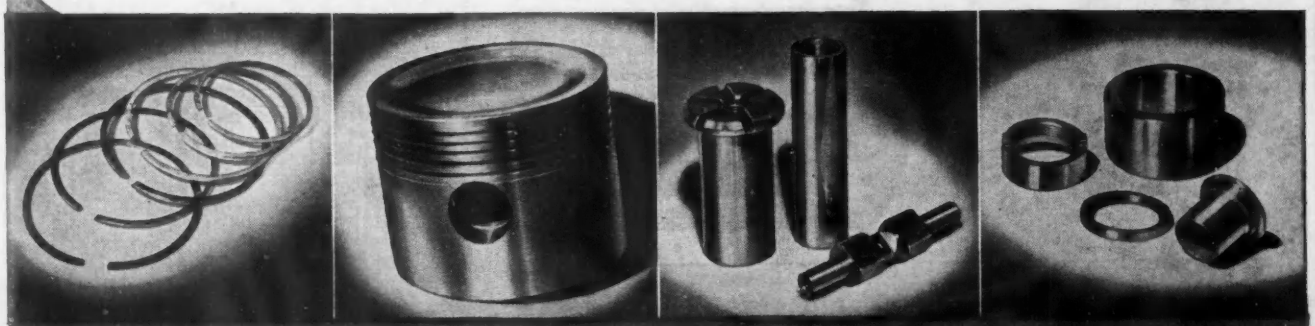
PARTS FOR AIRCRAFT ENGINES
Piston Rings
Oil Sealing Rings
Supercharger Rings
Carburetor Parts
Machined Aluminum Pistons
Piston Pins
Counterweight Cheek Pins
Machined Magnesium Parts
Cylinder Hold Down Nuts
Hardened and Ground Parts

PARTS FOR PROPELLER ASSEMBLY
Machined Magnesium Parts
Piston Rings

EQUIPMENT FOR MAINTENANCE OF AIRCRAFT
Pistons for Oxygen Compressor
Piston Rings for Oxygen Compressor
Pins for Oxygen Compressor
Pistons for Air Compressor
Pins for Air Compressor
Piston Rings for Air Compressor

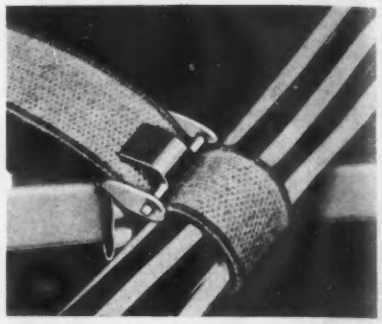
LANDING GEAR PARTS
Machined Aluminum Pistons
Piston Rings
Hardened and Ground Parts

PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



McQUAY-NORRIS MFG. CO. (AIRCRAFT DIVISION), ST. LOUIS, U.S.A.
CANADIAN PLANT, TORONTO, ONTARIO

New Products for Aircraft



Odel universal wire harness support strap

Simplified Support Strap for Electric Wire Harness

A simplified universal electric wire harness support strap is now in production at Adel Precision Products Corp., Burbank. Cal.

Designed to permit quick one-hand installation and removal of wires, the new support consists of a light-weight, synthetic, sponge-rubber coated fabric strap ⅝ in. wide which has a 2800 p s i tensile strength—a buckle which mounts on a 360 deg. swivel-latch, permitting attachment at any angle.

One size of strap replaces all sizes of harness clips as the strap support will carry from one to fifteen wires cushioned by the sponge rubber so that no metal part can cause abrasion of the wires. When a single wire is carried, the strap end may be clipped off.

Several types of mounting brackets are available which clamp securely to airframe structure without the necessity of drilling holes. However, the strap can be furnished with screw or rivet hole provision depending on customers' requirements.

Straps may be tightened securely on various-sized bundles of wires or may be locked loosely according to preference. Cold box tests show that the strap retains flexibility at 70 deg. F., thus complying with requirements of the Army winterization program.

A Motor Problem?

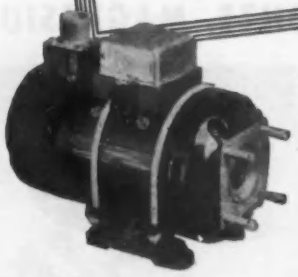
IN DEVELOPING THAT NEW PRODUCT

If you want reliable motor performance make sure—

1. That you consider the motor in the early stages of product development.
2. That the motor is specially designed for your particular application.
3. That it will be rigidly tested under actual operating conditions.
4. That the motor manufacturer will maintain the high standards of workmanship represented in the sample submitted for testing.

Our many years' experience covering all types of fractional horsepower motors is available to your engineering department.

THE BLACK & DECKER ELECTRIC CO.
KENT, OHIO



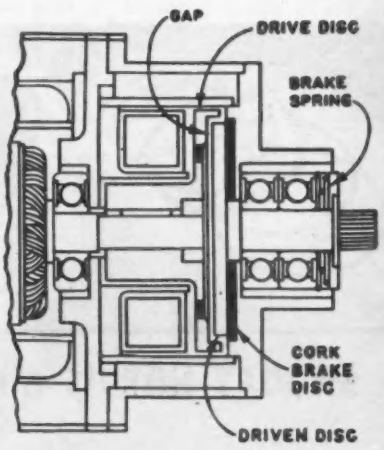
THOROUGH ENGINEERING is the basic factor behind the successful operation of this hydraulic pump motor and many other fractional horsepower motors we have designed for all types of equipment.

Black & Decker
FRACTIONAL HORSEPOWER SPECIAL APPLICATION MOTORS

Clutch for Use with Aircraft Electric Motors

Lear Avia, Piqua, Ohio, has brought out the Fastop electro-magnetic clutch for use with Lear aircraft motors. The Fastop clutch releases the motor rotor from the load when the circuit is de-energized. The rotor thus is allowed to run down at leisure, while the mechanism which carries or operates the load stops instantly. The element of time involved in this disengagement between the rotor and the output shaft is about one fiftieth of a second.

The principle of this instantaneous



Fastop electro-magnetic clutch

VERSATILE HANSEN COUPLINGS...

HANSEN COUPLINGS are versatile, in that they are made for a wide range of uses, such as for air, oil, grease, oxygen, gasoline and acetylene. Designed, engineered and built to handle air, liquids and gases in the most efficient manner with absolutely no losses whatever due to leakage. Hansen couplings will safely handle pressures from 2 ounces to over 10,000 pounds.

Extremely easy to operate, merely push plug into socket, it is locked absolutely tight, slight pull on sleeve, it is unlocked and detached. When plug is inserted in the air, oxygen, or acetylene couplings, it automatically opens the valve and automatically closes it when plug is ejected . . . No twisting, turning or locking, complete swivel action eliminates kinking of hose line.

Large illustration at left shows Push-Tite coupling which handles air, oil, and grease while couplings illustrated below handle gas, acetylene and oxygen.

Send for Free Catalog

AIR, OIL—GREASE COUPLING

CUTAWAY SECTION

HANSEN

MANUFACTURING COMPANY
1786 EAST 27th STREET
CLEVELAND, OHIO

GASOLINE COUPLING

ACETYLENE COUPLING

OXYGEN COUPLING

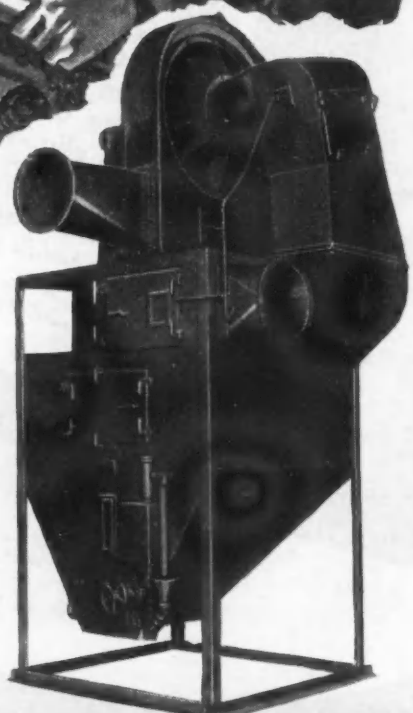
Engineered DUST CONTROL has proved its worth in a world at war!

● Until the advent of war with its rigid demands for increased production, the control of industrial dusts was considered desirable, but not vital. However, War changed many things and *Dust Engineering* soon assumed its rightful place as an essential part of *production planning.*

The importance of *Dust Engineering* — protecting materials in process, reducing rejects, increasing worker efficiency and reducing maintenance costs — is fully attested by the fact that we continue to deliver more dust control equipment each year.

If you have a troublesome or dangerous dust condition, write us about your problem. Send for "AAF In Industry," a new booklet describing the complete line of AAF equipment.

At right—The Type W Roto-Clone, wet dynamic dust precipitator. Send for engineering Bulletin #274A.



ROTO CLONE — ANOTHER AAF PRODUCT

AMERICAN AIR FILTER CO., INC.
INCORPORATED
449 CENTRAL AVE. LOUISVILLE, KENTUCKY
IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.

stoppage between motor and load involves an operating solenoid connected in series with the motor. There are two solid metal discs. One is connected directly with the rotor, called the drive disc. The other is connected with the output shaft and is called the driven disc. The driven disc is solid, but the rim of the drive disc is separated from its center portion by a non-magnetic metal. In this way, north and south magnetic poles are formed when the motor is energized, and the drive disc becomes a magnet. When energized, the driven disc is attracted to the driver and immediately starts to revolve at the same speed as the motor.

The output shaft contains a small spring which draws the driven disc away from the driver at the very instant the current is shut off, snapping it back against a cork face which serves as a braking surface.

Fittings for Bullet Sealing Hose

Aeroquip Corporation, Jackson, Mich., is introducing fittings for bullet sealing

Aeroquip fittings for bullet sealing hose

hose which are similar to Aeroquip standard hose fittings now in use on all Army and Navy combat airplanes. The swivel type fitting consists of three pieces (hose retaining socket, nipple, nut) each of which is individually replaceable. Assembly is accomplished by screwing nipple into socket. Once assembled there is no need for further tightening and servicing.

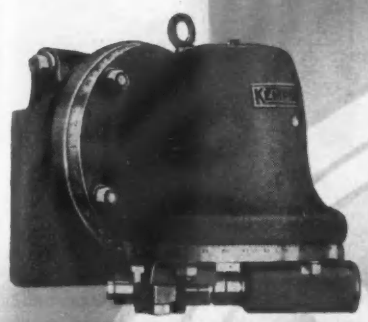
The fitting can be reused repeatedly with new hose. The dimensions of the fitting are small and are kept within approximate dimension of the hose.

Rivet and Gun for Emergency Repairs

Huck Manufacturing Company, Detroit, Mich., offers a new blind rivet and a hand gun for driving the rivet, for use in emergency repair work where neither compressed air or electricity are available. The rivet is of a universal

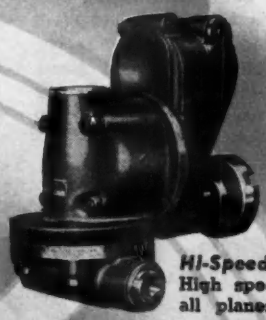
Huck rivet gun

Keep Wheels of Industry Rolling with KEMPSMITH *Standard* ATTACHMENTS

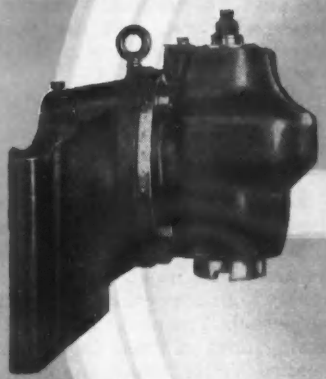


Heavy Duty Universal
Heavy duty angular milling in all planes. (Bulletin No. 104)

Circular Table
Milling circles or cams, gear cutting, high-speed continuous milling, etc. (Bulletin No. 106)

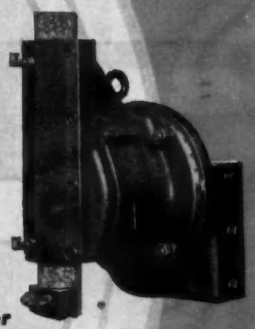


Hi-Speed Universal
High speed angular milling in all planes. (Bulletin No. 113)



Vertical Head
Converts horizontal to vertical machine, retaining identical spindle characteristics. (Bulletin No. 105)

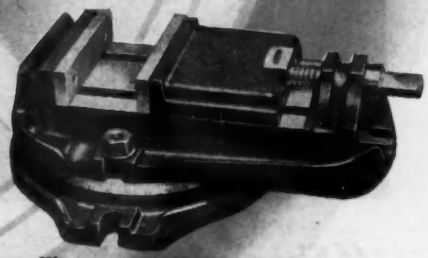
BROADEN THE SCOPE OF YOUR MILLING MACHINES



Slotter
Keyseating, broaching, general slotting, tool and die making, etc. (Bulletin No. 107)

Arbors and Accessories
A full range for standardized spindles carried in stock. (Bulletin No. 118)

Dividing Head
Precision indexing. Spiral cutting mechanism and chuck also available. Bulletin 119.



Vises
Standard and Heavy-Duty, plain and swivel types. Adaptable to special jaws to save fixtures. (Bulletin 117)

Convert your general duty milling machine to a special purpose miller by utilizing Kempsmith Standard Attachments.

It's really surprising, the great variety of milling operations that can be handled by Kempsmith *Standard* Attachments mounted on a standard milling machine. The same high degree of rigidity and precision characteristic of Kempsmith Milling Machines for more than 56 years is embodied in these sturdy standard attachments. Thousands are serving industry, every day, performing the most delicate and accurate operations, or handling difficult production milling jobs.

So plan now on broadening the scope of YOUR milling machines by applying Kempsmith Standard Attachments. Write for bulletins designated above.

THE KEMPSMITH MACHINE CO. • Milwaukee 14, Wis., U. S. A.

KEMPSMITH

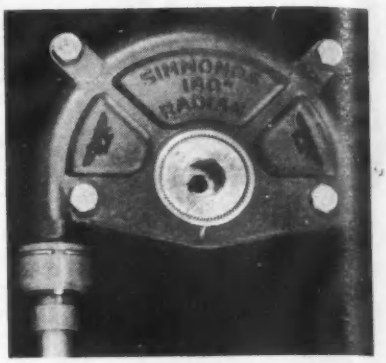
• Precision Built Milling Machines Since 1888 •

type in that one grip length will suffice for any combination of sheet thicknesses from .050 in. to .300 in. A small hand gun, weighing less than 2 lb and capable of exerting a pulling force of 1000 lb has been developed.

The new rivet differs from the standard blind rivets manufactured by this company in that the Huck method of driving a collar to lock the pin securely in the sleeve has been eliminated. Another difference is that the new rivet forms a tulip blind head, whereas the standard rivet forms a bulbed head. The holefilling action of the repair rivet does, however, anchor the pin in the sleeve by friction. However, because of the value of simplicity in the case of emergency repair work the advantage features of the lock and bulbed head are considered secondary.

Rotary Motion Action from Push-Pull Operation

The Radian unit, a device providing positive rotary-motion action from push-pull operation, and designed for use in connection with propeller governors, carburetor air controls, supercharger controls, and similar aircraft installations, is being made by Simmonds Aerocessories,, Inc., New York, N. Y.



Radian unit made by Simmons Accessories, Inc.

Weighing approximately 12 ounces, the Radian unit, which replaces the pulley-and-cable and rod-and-bellcrank assemblies, has three basic parts; a housing, a lever-arm, and a bushing. The housing contains the track of the linkage path, the lever-arm carries out the angular travel, and the bushing transfers the angular travel to the shaft to be actuated.

Bullet Sealing Oil Tanks

The Firestone Tire and Rubber Company, Akron, Ohio, has created a nonmetallic shell for aircraft oil tanks which is said to react satisfactorily to gunfire and at the same time withstand reasonably high temperatures for a prolonged period. This was done by impregnating plies of glass fabric with a resin called Velite, which the company developed. The result is a smooth supporting material which neither shatters nor "flowers" nor is distorted when struck by a bullet.

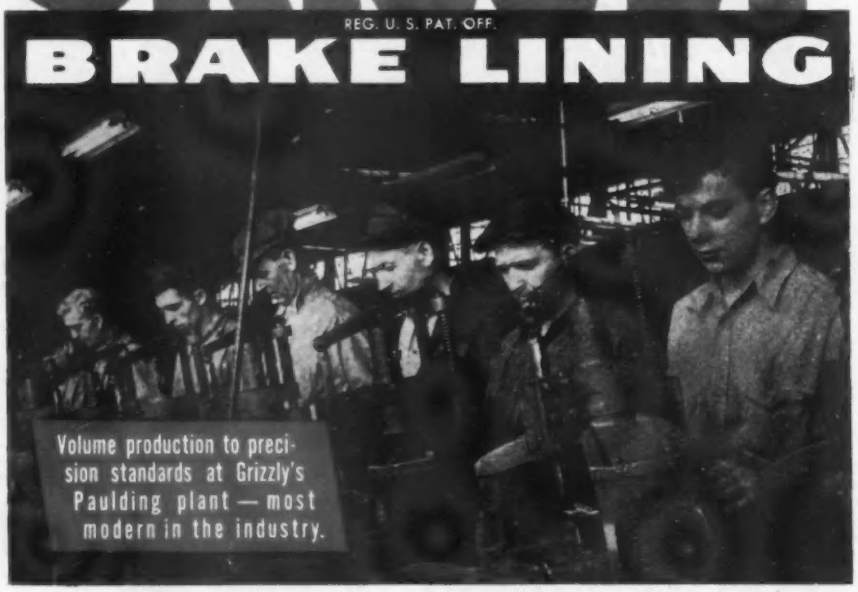
Instead, the bullet merely leaves a thin slit in the material. The oil tanks and the shell are cured as one unit, and a very rigid structure is obtained. The sealing portion of the tank is supported after gunfire, and oil leakage is cut to the lowest point yet obtained.

Push-Pull Circuit Breaker for Aircraft

The "push-pull" feature of the klixon D-6751, made by Spencer Thermostat Company, Attleboro, Mass., is new in

Klixon D-6751 "Push-Pull" circuit breaker

GRIZZLY
REG. U. S. PAT. OFF.
BRAKE LINING



"Special Purpose" Equipment

. . . designed and built by Grizzly Engineers—is one of the factors responsible for Grizzly's position of importance in the automotive industry, where precision manufacture in great volume is a primary requisite for success. For example special machines, of exclusive design like those above, process only one segment for one model of car. They cannot be changed—dimensions cannot vary—production is continuous without interruption.

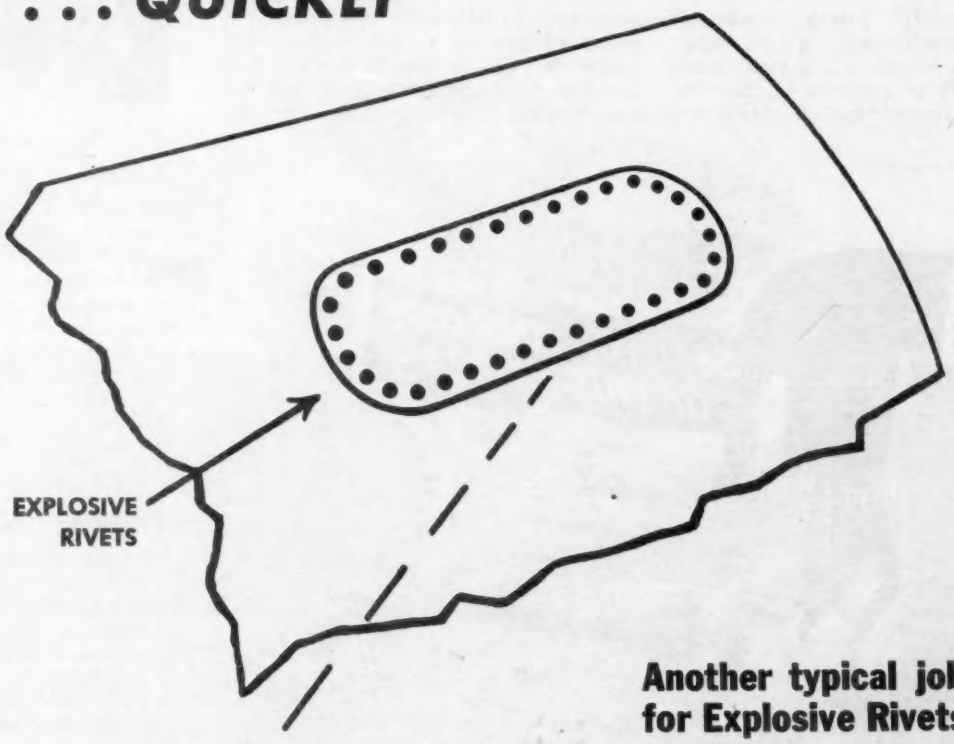
Equipment manufacturers should investigate the engineering and production advantages that assure, in Grizzly Brake Linings, labor-saving installation plus longer life of efficient service with remarkable freedom from adjustment.

WRITE—*for your copy of* ***"Building UP to a Name"***—*our photographic report of brake lining manufacture. Address the Engineering Department, Paulding, Ohio.*

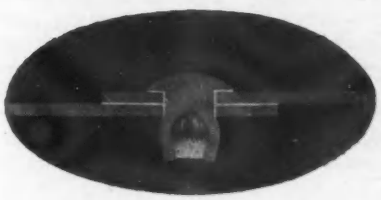
GRIZZLY MANUFACTURING COMPANY
PAULDING, OHIO
PLANTS AT PAULDING AND LOS ANGELES
Warehouse Stocks in Principal Cities

FASTENING COVER PLATES

. . . QUICKLY



Another typical job for Explosive Rivets



WHERE access hole cover plates are to be permanently attached, Du Pont Explosive Rivets permit doing the job quickly and easily.

The plate is clamped in position. Holes are drilled and Explosive Rivets are inserted in them. Then the tip of an electrically heated Du Pont Riveting Iron is applied to the rivet heads and . . . that's all there is to it.

The iron fires a tiny charge concealed in the shank of the rivet. This forms a strong, blind head, securely setting the rivet in place.

Riveters can readily set from 10 to 20 Explosive Rivets a minute . . . and when attaching permanent cover plates, they can reduce costs and save time by as much as forty to fifty per cent.

Look into this modern way of blind riveting. Determine now where Du Pont Explosive Rivets will save you time and money. Write for folder, "How to Use Du Pont Explosive Rivets." E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, 5494 Nemours Building, Wilmington, Del.—5-238 General Motors Building, Detroit, Mich. —5801 South Broadway, Los Angeles, Calif.

DU PONT
REG. U. S. PAT. OFF.

EXPLOSIVE RIVETS

The one-piece blind fastener

aircraft circuit breakers. The "pull" feature permits the opening of the circuit breaker manually, in order that maintenance and repairs to the circuit can be accomplished without deenergizing the entire power system.

The pull to the off position requires deliberate action and retains the feature of being safe against accidental tripping when operating adjacent switches.

The "push-pull" button travels outwardly approximately ¼ in. upon tripping and exposes a 3 colored band, part of which is luminous so that indication is given under all conditions. A specially designed shunting switch is incorporated which provides non-trip-free action.

Automatic Pilot for Army Gliders

The automatic pilot for Army gliders, just announced by Jack & Heintz, Cleveland Ohio, is an adaptation of the automatic pilot manufactured by this company for military planes.

By the use of this device the glider can be set to follow the tow plane at a given altitude on a true course. This means that gliders may be flown in bad weather which formerly grounded the gliders since it was necessary for the glider pilot to be able to see the tow plane. With the Jahco automatic pilot this is no longer necessary.

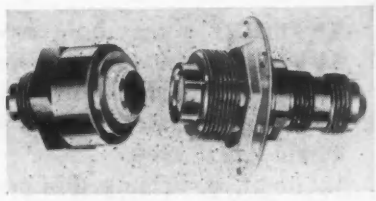
Jahco automatic pilot

The instrument appears in the glider very much like the corresponding instrument for an airplane. In the glider a small air-driven propeller furnishes power for the hydraulic and vacuum pumps which operate the gyro units, and these in turn operate the controls of the motorless plane.

Self-Sealing Coupling

Aeroquip Corporation, Jackson, Mich., is introducing an improved self-sealing coupling allowing disconnection and reconnection of hydraulic or other lines without loss of fluid or inclusion of air. Seal is affected by an O-ring embedded in a recess of the body. One-half can be provided with a detachable mounting flange.

On connecting the coupling halves, the protruding portion of the left half makes contact with the sleeve of the other body. Simultaneously all air is expelled between the mating parts of the halves, thus preventing it from entering the system. Further movement of the union nut will move the valves until a position is reached allowing free passage of fluid. Actual service experience is said to have proven that there is practically no restriction when the coupling is completely coupled, and consequently self-sealing couplings can be successfully installed in suction lines.



Aeroquip coupling

Self-sealing couplings are made conforming with specification AN-C-65. In order to make installation of new improved design possible, a complete set of self-sealing couplings conforming with above specification has also been made available with AC-811 type and connections.

"Next best to *knowing* is knowing *how to find out.*" That's why we published this file-size folder—**CAMPBELL ABRASIVE CUTTING MACHINES.** It's a time-saver because it gives you a quick highlight picture of the complete range of Abrasive Cutting Machines made by Campbell. It may suggest to you the particular machine that will help you with your specific cutting problems. You'll want a copy for your files.

Another way to "find out" is this: write to us stating (1) the materials you are cutting, (2) shapes and sizes, (3) lengths before cutting, (4) lengths of cut-off pieces and (5) required production per hour. With this information, Campbell engineers can work up cost sheets for you and recommend production procedure, based on actual records.

Write for the above folder. Or, even better, write for information on your specific cutting problem.

Campbell ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION · Bridgeport, Connecticut

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

I PREDICT . . .

By Egmont Arens

Leading Industrial Designer

I predict quantity production, right after the war, of unsinkable boats with continuous skins, tougher and lighter than wood, hull and top sides molded in one piece of Co-Ro-Lite, a new molding material consisting of plastic bonded rope fibres. Scale models of such boats are now being tested under a variety of conditions, and hulls of similar construction up to 32' have already been successfully molded. Light weight, speed and low cost will be overall outstanding features. The skin-stressed monocoque construction produces a light weight hull and top. An aluminum aircraft-type engine, housed out of the way in a small space under the aft deck, will provide speed and low operating expenses. Production by molding assures low initial cost, and a one-piece hull, eliminating yearly overhaul and caulking, means low upkeep. Thus motor-boating will be a pleasure everyone can buy with their War Bonds when Peace is restored.

* * *

Note: The Weatherhead Company, one of the oldest and most important manufacturers of parts for the aviation, marine, automotive and other key industries, looks forward to the day when its four plants will be contributing to peacetime needs.

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.*

then he said to himself

"I hope they don't ask me HOW!"

Pierre Laval, on being handed the mouthpiece by Adolf, promptly broadcast to the French people:

> "In the New Europe, it is socialism that will be installed . . . In the New Cities, labor will be protected, honored and magnified, as well as those spiritual and moral values that may blossom there."

Just like that he solved France's problems of postwar.

Of course, we all smile derisively as we think how promptly after that, labor was pushed into railway cars and whisked into forced production in other lands.

And we smirk as we contemplate the "spiritual and moral values" that have blossomed since.

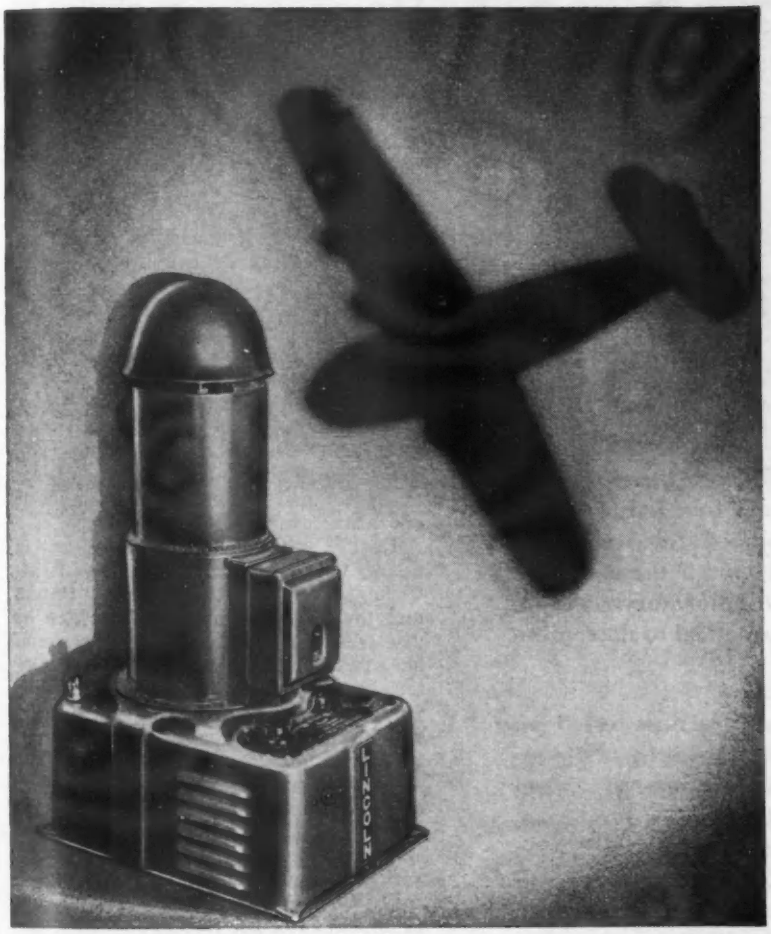
But here at home, we accept as gospel the glorious promises of our social planners for oodles of streamlined super-products the people will get for a song.

Rarely do we ask, "BUT HOW!!"

"Protected, Honored and Magnified"—*he says*

Look, Pierre, under your own or any *new social order,* a small group of soft-handed *theorists* like yourself could never give a *practical* answer to the challenge: "BUT HOW?" Yet under an old American *free enterprise* system . . . where protection, honor and magnification are in every man's grasp—*workmen* down in most metal working plants can themselves answer: *HERE'S HOW!!* (How to get MORE products. — How to get BETTER products. — How to get products AT A LOWER COST —so that more people can *afford* to buy).

HOW TO PRODUCE BETTER AIRCRAFT AT LOWER COST



RECOURSE to Arc Welding leads to advancement in aircraft design and construction . . . assures maximum strength of members . . . makes possible *real mass production* for minimum costs.

The New Lincoln "Shield-Arc Jr." Aircraft Welder contributes this:

Current settings as low as 10 amperes can be obtained, making possible a new high standard of welding thin-gauge aircraft metals and alloys. Its output can be adjusted in extremely fine increments of both current and voltage.

Teamed up with the new "Planeweld" Electrodes and the Lincontrol (foot-operated control), the New "Shield-Arc Jr." steps up speed and quality of aircraft fabrication.

Full details in Bulletin 338 . . . free on request.

THE LINCOLN ELECTRIC COMPANY • CLEVELAND 1, OHIO

America's greatest natural **recourse**

ARC WELDING

Leading Millions of Horses *to Water*

The power of a thousand horses in a giant aircraft engine is always available because they are first led to water. Clayton Dynamometers have revolutionized the testing of new, rebuilt and overhauled engines, through their unique method of harnessing water to provide laboratory-accurate measurement of horse power. Now it is practical to determine the condition of every engine.

All types of internal combustion engines are now tested on Clayton Hydraulic Dynamometers. Light-weight self-controlled equipment checks tanks and trucks overseas . . . production plant models test marine diesels, engines for tanks, aircraft power plants. Clayton Dynamometers are built with a minimum of critical materials, are simple to operate and greatly reduce the cost and bulk of testing equipment. The complete line includes models from 50 to 4000 hp. capacity. After the war, they will again be available to improve performance of automotive and industrial power plants.

Other Clayton products serving the Armed Forces are Kerrick Kleaners . . . Kerrick Cleaning Kompounds . . . Clayton Steam Generators . . . Clayton Boring Bars and Bar Holders, and Clayton Hydraulic Liquid Control Valves

CLAYTON
MANUFACTURING CO.
ARMY NAVY
ALHAMBRA
CALIFORNIA

Truck Problems

(*Continued from page* 44)

level inspection. The radiator inlet fitting, he said, should be as large as practicable and be designed to reduce the velocity of the coolant entering the tank.

The use of a high quality (heavy duty) oil having good resistance to oxidation and to the formation of sludge and acid is the most important method of controlling hot engine sludge, it was emphasized by H. C. Mougey of the General Motors Research Laboratories. Other steps recommended by him as helpful in controlling sludge are the use of filters, adequate temperature control and frequent draining of the crankcase. The principal difference between hot engine sludge and cold engine sludge, he said, is that the former contains large amounts of resins resulting from the oxidation of oil in the crankcase, but it is relatively free from water and soot. Cold engine sludge contains large amounts of soot and usually some water, but is relatively free from resins.

In discussing the problem of cold engine sludge B. E. Sibley of the Continental Oil Co. advocated good supervision in maintaining normal engine temperatures, the use of a good quality oil, in combination with effective filters and air cleaners, sane crankcase drain periods, and the draining of the oil hot as the majors items in controlling it. Improvement also can be had by using lubricating oils of the detergent type, a conclusion substantiated in a survey of 37 commercial motors vehicle fleets operating over 37,000 vehicles.

Earl G. Gunn, vice president in charge of engineering at the Fram Corp., presented the paper, "Filters and the Sludge Problem," in which he disclosed that a check on a large number of automobiles during the past winter showed that the crankcase oil (solids free) often contain two per cent by weight of soluble resins, which indicates that oxidation takes place to a marked degree even in cold weather. As to what becomes of additives, tests show that filters containing activated material remove them, only, as solids with additives adhering are removed.

Lt. Col. C. W. Vogt, chief of the Technical Staff for Supply, Transportation Corps, War Department, explained the construction and operation of a tire-vulcanizing device employing electronic principles that he and Eino Lasko developed in the Forest Products Laboratory at Madison, Wis., after reports from overseas stated existing equipment to be slow and unsatisfactory. It is claimed that the electronic machine enables tire repairs to be made in 10 min. The new device, consisting of a press ram equipped with an electrode coupled to a high frequency generator and a press frame, creates heat internally to make spot and sectional cures within minutes. The ram and frame, fitted with filler bags, obviate the use of molds.

The "Jesse James" goes a-gunning

. . . outrunning anything it can't outshoot!

No wheels go along just for the ride on these tough M8-'s, nicknamed the "Jesse James". Normally, the four rear wheels supply the drive. But in tight spots the front wheels go to work, too . . . and the M-8 develops the agility of a range pony!

The transfer case and transmission that give the M-8 this surge of six-wheeled power are built by the Warner Gear Division of Borg-Warner. These important units are among a hundred Borg-Warner war items . . . every one built to the basic principle . . . "design it better—make it better".

Almost every American benefits every day from the application of this principle . . . for Borg-Warner has long played an important role in peacetime production.

All of the many Borg-Warner divisions are concentrated today on the task of giving our fighters the finest . . . to help bring our boys back safely and soon.

Partners with the automotive and aviation industries in peace and war, Borg-Warner supplies these and other essential parts.

CLUTCHES AND CLUTCH PARTS • GEARS
UNIVERSAL JOINTS AND DRIVE SHAFTS
TRANSMISSIONS • CARBURETORS • PUMPS
TIMING CHAINS • RADIATORS
AVIATION STEEL

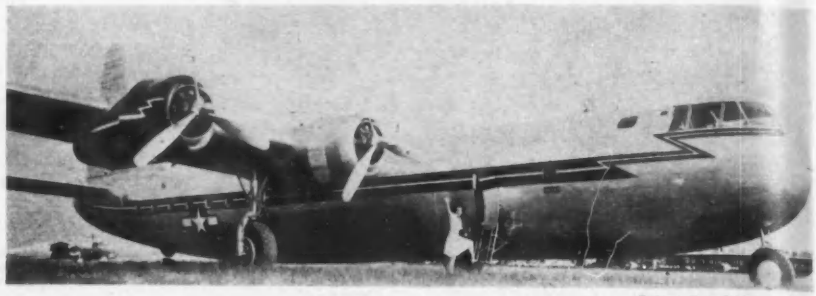
ENGINEERING B-W PRODUCTION

BORG-WARNER

Peacetime makers of essential operating parts for the automotive, aviation, marine and farm implement industries, and of Norge home appliances . . . these units which form the Borg-Warner Corporation are today devoted exclusively to the needs of war: BORG & BECK • BORG-WARNER INTERNATIONAL • BORG-WARNER SERVICE PARTS • CALUMET STEEL • DETROIT GEAR AIRCRAFT PARTS • DETROIT VAPOR STOVE • INGERSOLL STEEL & DISC • LONG • MARBON • MARVEL-SCHEBLER CARBURETER • MCCULLOCH ENGINEERING • MECHANICS UNIVERSAL JOINT • MORSE CHAIN • NORGE • NORGE MACHINE PRODUCTS • PESCO PRODUCTS • ROCKFORD CLUTCH • SPRING DIVISION • WARNER AUTOMOTIVE PARTS • WARNER GEAR

Liberator Liner Carries Big Payload

This Consolidated Vultee plane is an enlarged commercial version of the B-24 Liberator bomber. It is said to be capable of carrying 48 to 50 passengers and to have a range of 2500 miles, carrying 2500 lb. of cargo in addition to the passenger load.



International News photo

"Chicago" Ported Valve Tappets are being used extensively in diesel and gasoline engine fields. Over years of service and under severe conditions these tappets have proved that they can "take it". . . In specifying valve tappets—there are many advantages to be gained by insisting upon "Chicago" Ported Valve Tappets. These quality products are made from a special grade of alloy cast iron, assuring uniform "clear chill" depth at the cam face . . . The "porting" feature of these tappets has a definite advantage in providing lubrication of tappet guide holes . . . Exacting inspection operations guarantee machining and grinding to the highest standards of quality . . . "Chicago" Ported Valve Tappets are made in a wide range of sizes to meet our customers' individual specifications.

ARMY E NAVY

THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 So. Homan Avenue Chicago, Ill.

Booklet Simplifies Contract Termination

Major questions confronting war contractors are answered in a new booklet, "*The Contractors Guide*," according to an announcement by the War Department. The work is the result of months of field experience by the procurement services, and of studies and suggestions from industry and national trade associations as reported to the Readjustment Division, which has staff function in making policies to handle the increasing load of termination settlements.

Contracts are being terminated now by the field officers of the procurement services in order to clear the way for manufacture of new and better weapons coming from the drawing boards and laboratories, and from tests at the fighting fronts. "The Contractors Guide" is designed to aid industry by giving the busy executive a quick preview of the job to be done. This publication, for both prime and subcontractors, will be available at the procurement offices of the War Department throughout the country.

Wolfram to Succeed Youngren at Olds

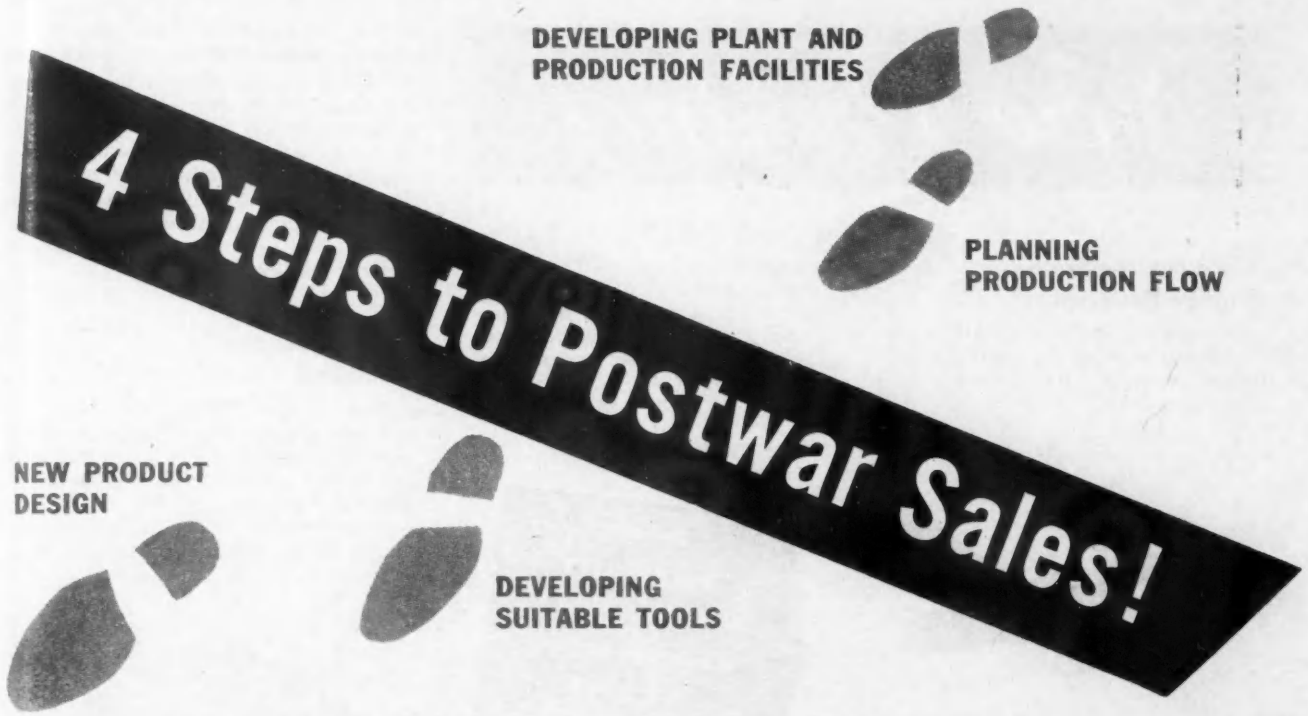
J. F. Wolfram, associated with the Oldsmobile engineering department for the past 16 years, has been named chief engineer to succeed H. T. Youngren who has resigned. Mr. Wolfram has served Oldsmobile as assistant and chief experimental engineer, and assistant chief of all product engineering.

Come Across

for the

Boys who have

Gone Across



SIEWEK SPECIALIZED ENGINEERING

Encompasses All These Steps

● Development work on postwar products is an extra burden on many war-busy manufacturers of today.

Whether your company has already taken any of the steps mentioned above, or is "just thinking about them," Siewek Engineering Division is prepared to cooperate —to develop, or realize, a plan for you.

This nationally known organization of experienced engineers and skilled tool designers is qualified to give exactly the service your needs require: developing ideas and products—designing, building and laying out machines and tools.

For your postwar plans, take the initial step of calling in Siewek—to take the other 4 steps with you—or for you. Ask a Siewek representative to stop in and discuss your problems with you.

★

SIEWEK TOOL DIVISION
OF DOMESTIC INDUSTRIES, INC.

Manufacturers

of

SIEWEK CLAMPS

SIEWEK
RAPID CLAMPING
DRILL JIGS

SIEWEK SHEAR-CUT
END MILLS

SIEWEK

Designers and Builders of Tools, Dies, Jigs, Fixtures and Special Machines

ENGINEERING DIVISION
OF DOMESTIC INDUSTRIES, INC.

Chicago: 510 N. Dearborn St.
Hartford, Conn.: 209 Pearl St.
Springfield, Mass.: 11 Stearns Sq.

New Products

Rubber Plate Separators for Storage Batteries

A microporous, wafer-thin rubber is now replacing wood in the manufacture of storage batteries. Its use as a plate separator makes possible the shipment of these batteries to all battlefronts in a fully charged condition but without the acid and water heretofore necessary to insure the electrical charge as well as the life of the battery.

This material was developed by the United States Rubber Company, New York, N. Y. It has millions of tiny cells per square inch. Unlike wood, it will not buckle should the protecting acid and water mixture become low or completely expended. This compound is said to have higher resistance to abrasion and chemical reaction than wood. The separators are designed to outlast the life of the battery.

Hose Reels for Industrial Use

The Wayne Pump Company announces a new line of hose reels for industrial use which will be marketed under the name "Wayne Retriever." They are improved models of the reels formerly known as Air Scale hose reels and are manufactured by the Air Scale

"Wayne Retriever" base reel

Division of The Wayne Pump Company, Delta, Ohio.

The Wayne Retriever line has many features. The hose unrolls freely and retrieves quickly with an automatic rewind spring. Ratchet clutch holds line at any desired length until released by a short forward pull. Automatic braking action prevents whip, lash or runaway. The universal bracket which permits mounting in any position is an important innovation.

New High Temperature Insulating Varnishes

As much as 50 per cent reduction in weight of electric equipment is said to be possible where design limitations are based on insulating temperature, by using the new Silicone insulating varnishes developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These high temperature insulations also make possible a substantial increase in the output of small motors using the same frame, where the operating temperature can be raised. They offer the additional advantages of ability to operate at higher ambient tem-

(*Turn to page 76, please*)

Aviation, Automotive, Bus, Truck, Electrical, Marine, Industrial.

The finest controls that experience, craftsmanship and materials can combine, are yours when you specify Arens.

Arens Remote Controls are recognized for their dependability and unfailing performance regardless of temperature changes, icing, or vibration.

Each Arens Remote Control is built to outlast the equipment on which it is installed and will give years of lowest cost operation with a minimum of maintenance.

We invite you to discuss your present remote control problems with an Arens engineering specialist.

WRITE FOR DETAILED INFORMATION AND CATALOG so that Arens engineers can give your particular problem study and recommendations. The selection of the right control for the job will insure long lasting satisfaction.

This locking type head is designed for use with manual remote controls—permits locking to any desired position. Will not slip.

A vernier type head which permits coarse and micro-fine adjustments by movement of one control head. Cannot slip-always in mesh.

ARENS CONTROLS, INC.

2256 South Halsted Street, Chicago, Illinois

PoweRated

For BALANCED POWER and PERFORMANCE

PoweRated Engineered for a Specific HP. Range

MEANS EVERY MILWAUKEE MACHINE IS POWER ENGINEERED TO DO THE JOB

Milwaukee *PoweRated* Milling Machines

- Standard Models — Horizontal, Vertical and Bed Types — available in Motor ranges from 3 to 25 HP.
- C.S.M. (Carbide Steel Milling) machines — 20 to 50 HP.
- Special Machines — Consult K&T engineers.

PoweRated ENDS THE WASTE AND HIGH COST OF "MONGREL" MACHINE TOOLS

Sound machine tool design demands thorough consideration of the motor hp. A No. 2 milling machine, for example, is designed and built in keeping with its motor hp. — plus the normal overloads to be expected in relation to the size of work to be milled.

Substituting a higher hp. motor to gain power and speed above that of the motor normally specified for a No. 2 milling machine results in a "mongrel" machine, incapable of sustained precision performance — as well as of doubtful value in terms of providing additional production in keeping with its "extra" cost. The power is excessive and out of balance with the design and construction of a No. 2 and its proper range of performance.

Milwaukee Milling Machines are power-engineered — *PoweRated* — each machine has a specific hp. rating in relation to the type of jobs to be milled.

When you are considering the purchase of a milling machine—think in terms of motor hp. for heavy cuts, range for light cuts. Check the advantages of Milwaukee *PoweRated* machines.

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14 WISCONSIN

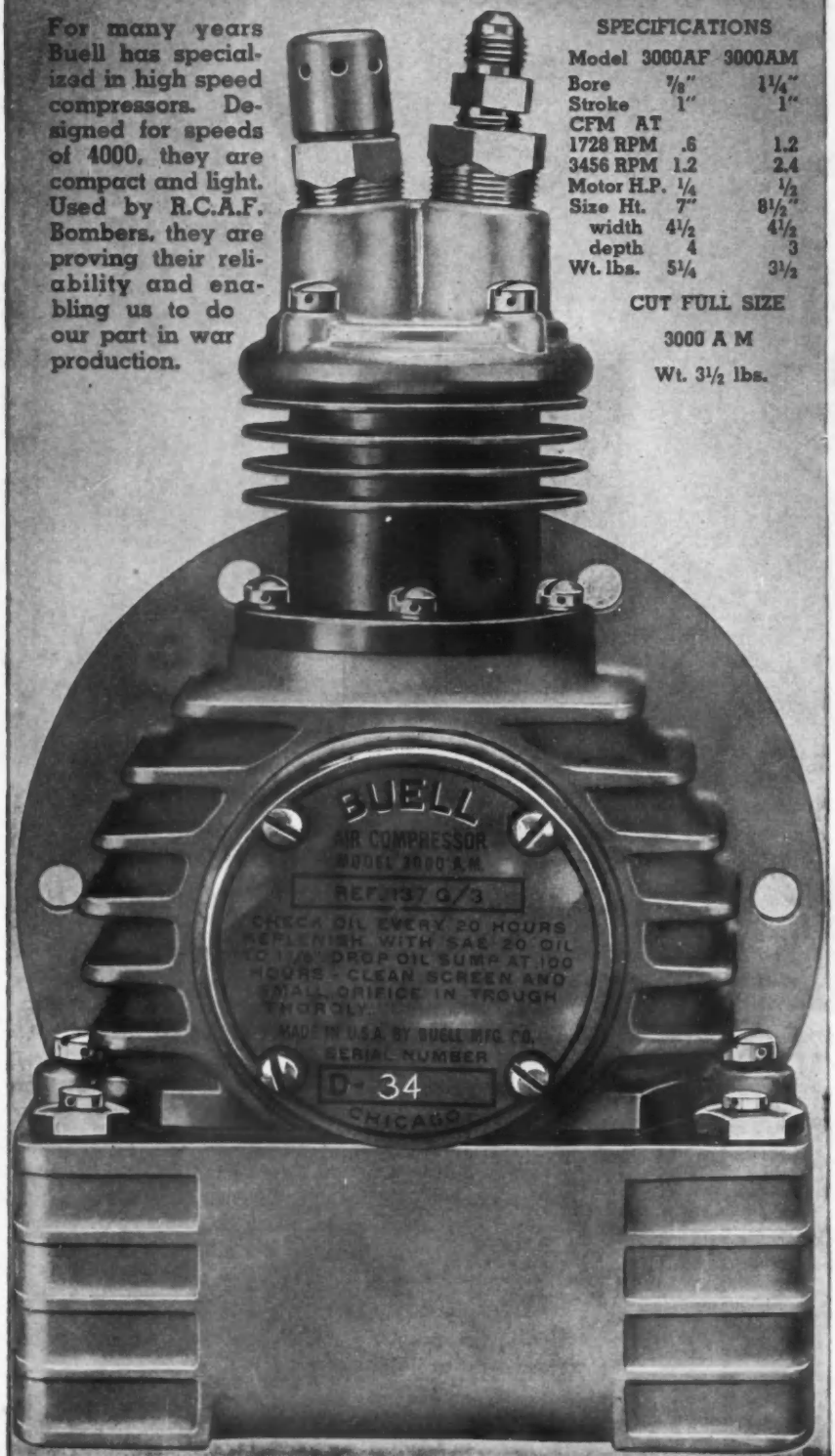
Back the Attack! **BUY MORE BONDS**

Milwaukee Machine Tools

BUELL . . . AIR COMPRESSOR

A precision built product with high alloy forged steel crankshaft, hardened and ground to close tolerances.

For many years Buell has specialized in high speed compressors. Designed for speeds of 4000, they are compact and light. Used by R.C.A.F. Bombers, they are proving their reliability and enabling us to do our part in war production.



SPECIFICATIONS		
Model	3000AF	3000AM
Bore	7/8"	1 1/4"
Stroke	1"	1"
CFM AT		
1728 RPM	.6	1.2
3456 RPM	1.2	2.4
Motor H.P.	1/4	1/2
Size Ht.	7"	8 1/2"
width	4 1/2	4 1/2
depth	4	3
Wt. lbs.	5 1/4	3 1/2

CUT FULL SIZE

3000 A M

Wt. 3 1/2 lbs.

BUELL MANUFACTURING CO.

Dept. AA, 2975 COTTAGE GROVE AVE., CHICAGO, ILL.

perature, and to greatly increase life when operated at present temperature conditions. Silicone resins, and their use as insulating varnishes and bonds, fill the void between organic and inorganic insulating materials.

Carbide Gage Blocks

The Jansson Gage Company, Detroit, Mich., has just brought out carbide gage blocks in sets. These blocks are said to be held to extremely close limits, often well within claimed tolerances.

Three all-carbide sets are available, of ten, two and two blocks respectively, and one set of 81 steel blocks with two .050 in. tungsten carbide wear blocks. The Jansson ten-block carbide set ranges in size from .050 in. to .0509 in. in steps of .0001 in. The two smaller sets are intended primarily to be used as wear blocks with steel gage blocks. One contains two .050 in. blocks, the other contains two .100 in. blocks.

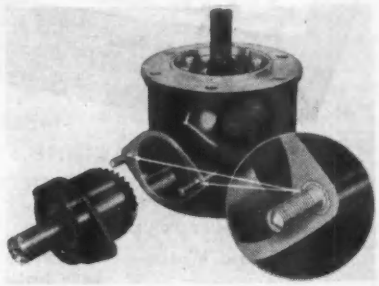
Low Pressure Hose Fitting

A new fitting, known as the low pressure Q-A fitting, for instrument and low pressure hydraulic hose lines, has just been announced by The Weatherhead Company, Cleveland, Ohio, which satisfies the condition whereby higher pressure effects a tighter seal between hose and fittings.

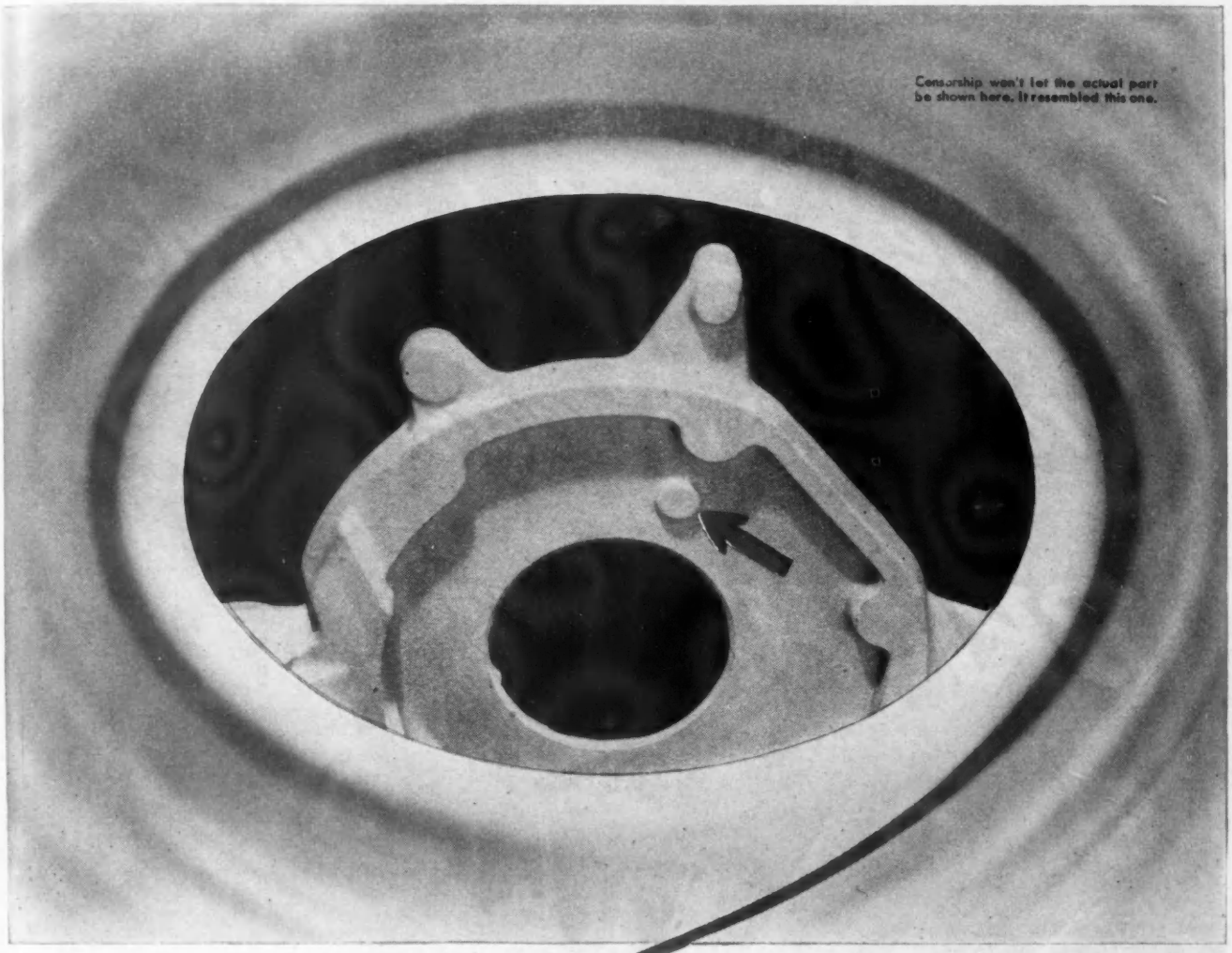
A floating seal derives from the design, which involves a simple assembly of stem and coupling nut, plus a free sleeve nut. Hose is run onto the stem which is provided with an annular hump. By reason of its wide angle gripping threads the sleeve nut, as it is turned onto the hose, becomes an inte-

(*Turn to page 80, please*)

Fastening Problem Solved



The Rosán locking system for threaded inserts and studs was used to solve the problem of fastening to a blind hole and locking the stud in the material so that vibration would not loosen the screw part and turn it out. After the stud is screwed into position, the locking ring is pressed or driven into a counterbore. The inner teeth of the ring engage the teeth of a serrated collar on the stud, while the outer teeth broach the wall of the counterbore to make a solid installation.



The boss was a troublemaker, until...

Examination in Alcoa's stress-analysis laboratory disclosed that the boss was a "stress concentrator". Having determined that here was the source of trouble which showed up in service, the part was redesigned. The fault was corrected.

Bosses, ribs, and the like, have a definite purpose. But when they are found to cause excessive stress concentrations, Alcoa's research men seek some way of distributing the stresses more uniformly. Our engineers may recommend a better blending of the sections, more metal here, less there. Then new parts, incorporating those suggestions, are given a stress analysis. Checked "O.K.", the piece is ready for test.

With research like this provided by Aluminum Company of America, manufacturers have been better able to get into production fast. Fighting equipment on land, in the air and on the sea is more dependable, because vital Alcoa Aluminum and magnesium parts were thus proved dependable.

Perhaps you have not been able to get materials for certain "civilian" uses. Winning the war comes first. But aluminum is now being used for other-than-war purposes, as the manpower situation permits. Our representatives will be glad to discuss the availability of aluminum with you. Write ALUMINUM COMPANY OF AMERICA, 2110 Gulf Bldg., Pittsburgh 19, Pa.

ALCOA ALCOA ALUMINUM REG. U.S. PAT. OFF. **ALUMINUM**

WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS • SUNDAY 2:30 EWT., N.B.C. •
"TOP OF THE EVENING" • MON., WED., FRI., 10:15 EWT., BLUE NETWORK

Phosphor powder particles, like human beings, are of infinite variety. Some are fat, some lean. Some are dull . . . and some are *bright!*

Determining the *size* of particle that has the most sparkle has proved one of the most exciting of Westinghouse research problems.

Out of thousands of batches tested, one size has consistently shown the highest degree of fluorescence. This discovery has resulted in the development of phosphor powders with the greatest life and sparkle.

These powders are now used in all Westinghouse fluorescent lamps. That's why the Westinghouse fluorescent lamp of today delivers bright, high efficiency light wherever it is installed.

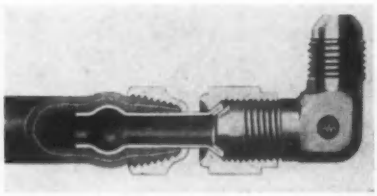
And that's why, when you order fluorescent lamps, it pays to ask for Westinghouse. Your Westinghouse dealer can supply you right now for essential war lighting . . . and also to a limited extent for essential civilian use. Westinghouse Electric & Manufacturing Co., Bloomfield, New Jersey.

HELP SHORTEN THE WAR . . . BUY MORE BONDS THAN BEFORE!

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY

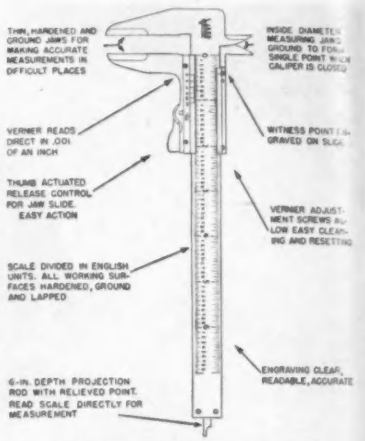


Weatherhead low pressure Q-A fitting

gral part of it. As the pressure is applied, it forces the stem out, and pulls the hose and tapered sleeve nut against the stem hump. As pressure increases, the seal is tightened. And, important in avoiding cold-flow tendencies in the hose, when pressure is decreased, the seal relaxes. The low pressure Q-A fitting is reusable, either on its original hose, or on new lengths, a feature which simplifies hose replacement work and the spare parts problem.

Precision Caliper

Vard, Inc., Pasadena, Cal., has just brought out a precision caliper for measuring inside or outside diameters. It is used also to measure the depth of a hole by inserting the depth projection rod and reading the distance from the end of the rod to the body of the caliper on the same scale. The depth gage is an integral part of the tool—not an attachment.


THIN, HARDENED AND GROUND JAWS FOR MAKING ACCURATE MEASUREMENTS IN DIFFICULT PLACES
VERNIER READS DIRECT IN .001 OF AN INCH
THUMB ACTUATED RELEASE CONTROL FOR JAW SLIDE. EASY ACTION
SCALE DIVIDED IN ENGLISH UNITS. ALL WORKING SURFACES HARDENED, GROUND AND LAPPED
6-IN. DEPTH PROJECTION ROD WITH RELIEVED POINT. READ SCALE DIRECTLY FOR MEASUREMENT
WITNESS POINT
VERNIER ADJUSTMENT SCREWS
ENGRAVING CLEAR, READABLE, ACCURATE

Vard precision caliper

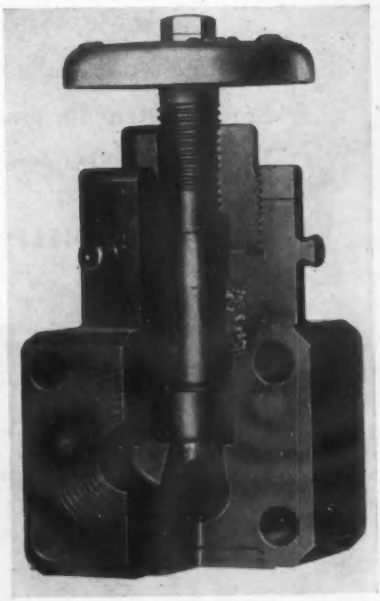
Vard vernier calipers are made on one size only—6 in. between the jaws. This 6-in. caliper has a full 7-in. of graduations on the face, thus making possible a full 6-in. reading.

The caliper is constructed of precision ground steel, its jaws are hardened and lapped. One edge is divided in 30 sec, the other in fortieths which read in thousandths in the vernier.

"Karbate" Corrosion Resistant Valves

A "Karbate" globe-type corrosion resistant valve is now being manufactured by the National Carbon Company, Inc., New York, N. Y. The new globe-type valves are said to be resistant to practically all corrosive chemicals and unaffected by extreme thermal shock.

(*Turn to page 82, please*)



"Karbate" globe-type valve

First in War
as They were in Peace-
"First in the Vehicles of AMERICA!"
For THAT VITAL SPOT where POWER TAKES HOLD OF THE LOAD!
BORG & BECK
The Standard Clutch in Peace or War!
BORG & BECK DIVISION
BORG-WARNER CORPORATION
CHICAGO, ILLINOIS

CLEANING AND RUST INHIBITING IN ONE OPERATION

with PENNSALT CLEANER EC-10*

Reg. U. S. Pat. Off.

Preparing "blitz cans" for welding presents a tough cleaning problem. Oil and grease must be removed, and the surface must be capable of receiving an even weld without rust from the coolant water used on the welding machine. Penn Salt's technical staff helped this manufacturer of "blitz cans" solve the problem.

A concentration of one part Pennsalt Cleaner EC-10 to 100 parts of water was used in a spray washing machine. This produced a very clean part with sufficient rust protection to last until the subsequent operation. So satisfactory was the result, that Pennsalt Cleaner EC-10 was promptly re-ordered.

How about *your* cleaning problem? Penn Salt's technical staff is at your service without obligation. Acid, Alkaline and Solvent-Type Pennsalt Cleaners are noted for their ability to solve difficult problems quickly, effectively, economically. Write fully to our Special Chemicals Division, Dept. AA.

SPECIAL CHEMICALS DIVISION PRODUCTS

Acid-Proof Cements • Alkali-Proof Cements • Lead Fluoborate Concentrates • Fluoboric Acid • Acid, Alkali and Solvent Emulsion Type Cleaners • Paint Strippers.

*Patent Applied for

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

New York • Chicago • St. Louis • Pittsburgh • Minneapolis • Wyandotte • Tacoma

Don't guess at Cutting Fluids

A cutting fluid is measured by its performance on a particular job. Yet it isn't necessary to try one oil after another until you hit the one which performs best. Engineering knowledge based upon experience can expedite your selection.

D. A. Stuart Oil Co. offer you the cooperation of skillful, trained engineers. Experience since 1865 has developed an insight into the fundamentals of cutting and grinding fluid application which is available to you with every drum of Stuart Oil.

There is a Stuart service engineer near you ready to help eliminate guessing at cutting fluids. Why not use him?

Having difficulties in thread grinding, gear grinding, form grinding? Investigate Stuart's grinding oils, including Thred Kut 99 grinding oil, SuperKool 81X, and Excelene.

Our new booklet, ***"Grinding With Oil,"*** tells the story. Write for a copy.

D.A. Stuart Oil co.

LIMITED

2733 SOUTH TROY STREET, CHICAGO 23, ILL.

ESTABLISHED 1865

Warehouses in Principal Metal-Working Centers

The valves are available in 1-in. and 2-in. sizes. Tested to withstand 50 lb pressure, they are small and lightweight, with short face to face dimensions. "Karbate" valves are of graphite stock and are self-lubricating. The inert chemical properties of the material prevents corrosion-caused sticking of the moving parts.

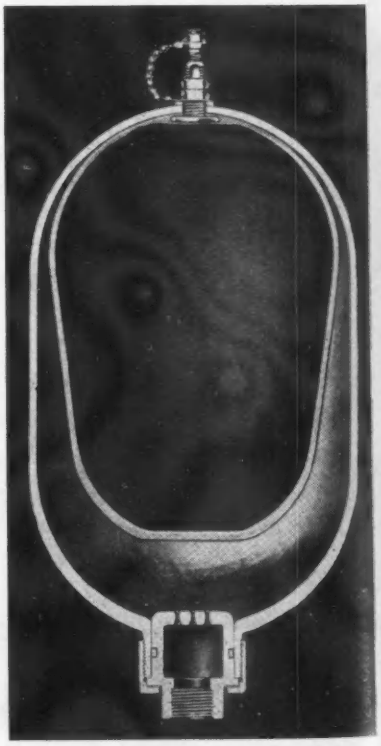
Adapter plugs, for steam-heating those fluids that tend to crystallize or solidify when handled through unheated lines, are regular equipment.

Hydraulic Accumulator for General Use

Greer Products Corp., New York, N. Y., offers a low-cost hydraulic accumulator for use in the machine tool, automotive, railroad and marine fields. The Greer hydraulic accumulator consists, essentially, of a seamless steel shell which contains a synthetic rubber bladder having an integrally molded air valve.

The accumulator is pre-loaded to the required pressure, from the regular shop air supply, through the air valve, with an air-booster pump. After the initial charge, the accumulator needs to be recharged only every three or four months. The hydraulic fluid is then introduced under pressure through a port in the opposite end of the shell. When the hydraulic system calls for the reserve fluid stored in the accumulator, the bladder expands until every drop is forced smoothly out of the shell.

Greer hydraulic accumulators are available for operating pressures up to 3000 psi, in capacities of .333, 1, 2½, 5, 10 and 25 gal. For larger capacities, a number of accumulators may be installed in the system.

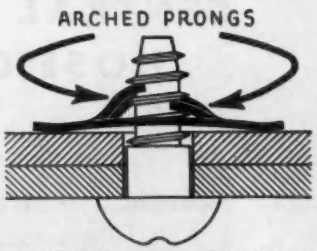


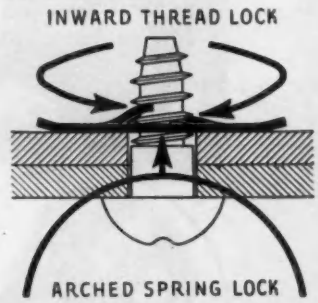
Greer hydraulic accumulator

Look at the Speed Nuts* [PATENTED]

SPRING-TENSION LOCKING ACTION!

FASTEST THING IN FASTENINGS!





An arched spring lock and an inward thread lock are basic features found only in Speed Nuts. The ingenious design that sets up these two forces accomplishes more than you'd realize unless you checked into it more closely.

Spring steel Speed Nuts have a base which is well arched, and arched prongs that are formed to follow the helical pitch of standard screw threads. As the screw is tightened, the arch is reduced, forcing the prongs deeper into the root of the screw threads. This provides a double spring-tension lock that prevents vibration loosening.

Speed Nuts eliminate the use of lock washers and are 50% to 75% lighter in weight than other self-locking nuts. They are faster to apply and drastically reduce assembly costs. Double your use of Speed Nuts and you will double your assembly savings. Write for literature.

TINNERMAN PRODUCTS, INC.
2059 FULTON ROAD • CLEVELAND 13, OHIO
In Canada . . . Wallace Barnes Co., Ltd., Hamilton, Ontario
In England . . . Simmonds Aerocessories, Ltd., London

The lightest weight self-locking nuts ever produced!

Carbo-hydrate Base Motor Fuels

(*Continued from page* 30)

grades there is a tendency—with the straight manifolds commonly used—for the wet fuel to flow from the front to the rear end, so that the front cylinders are starved at the very time when all cylinders are needed for full-throttle operation. To meet this condition it is recommended that, in combination with a heated sump, the ends of the manifold be made to slope upward toward the center at an angle to offset grades up to 15 per cent. These two expedients may solve the fuel distribution problem in part, and they will at least prevent draining of the fuel from the front toward the rear on up-grades.

However, the mixture in the manifold will still be quite wet, and this necessitates a study of the flow conditions of such mixtures. From past experience we know that in six-cylinder engines of the three-port type, where the end ports of the manifold supply two adjacent cylinders, with gasoline the mixture supplied to the inside cylinder of the pair is much richer than that supplied to the outside one. With alcohol, because of its different surface tension, the exact opposite effect is obtained, the outside cylinder receiving the richer mixture.

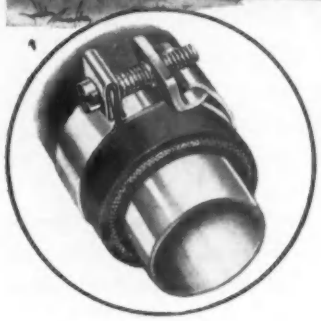
Present intake manifolds incorporate features designed to compensate for the tendency of gasoline to favor the inner cylinders of the end pairs, and as with alcohol the tendency is the exact opposite, these features, instead of improving the situation, actually aggravate it. This accounts for the very much greater variations in distribution with alcohol than with gasoline, at least in part. Acetone, even though its volatility is higher than that of gasoline, also gives rise to poor distribution, though not as bad as with alcohol. It is therefore recommended that all means of distribution control now used in the manifolds of gasoline engines be eliminated, and that a straight pipe with large radii at the ends be used. With gasoline such highly-curved ends have been the source of considerable trouble, as they tend to supply an excessive amount of fuel to the inner cylinders (Nos. 2 and 5) and to starve the outer ones (Nos. 1 and 6), but with alcohol, with its opposite flow tendencies, this would tend toward more nearly uniform distribution.

Good distribution of the alcohol-air mixture has been inferred from equality of spark-plug center-electrode temperatures. The spark plugs used in these tests were of the type designed by Rabezzana and Kalmar (AUTOMOTIVE INDUSTRIES, March 19 and 26, 1932). A plot of the center-electrode temperature against total engine fuel consumption yielded a parabolic curve with a vertical axis, from which the total fuel consumption at peak temperature could be accurately estimated. Rabezzana and Kalmar showed that the temperature peak occurred at a fuel consumption equal to 90 per cent of that corresponding to maximum power. The spread of the temperature peaks of the several spark plugs is a measure of the variation of mixture distribution to the different cylinders. At the peak of the temperature curve the power is approximately 99 per cent of maximum. Thus the distribution is evaluated under conditions similar to those obtaining in normal service.

Power and fuel-consumption tests were run on two commercial engines, with manifolds and compression ratios standard in gasoline-engine practice. The results are summarized in Tables IV and V.

Runs on engine "B" with blend No. 3 were made under different conditions of exhaust heating. In the first series the control valve was allowed to operate automatically; in the second, the valve was adjusted to cause the same intake-temperature rise as occurred with gasoline and automatic temperature control, while in the third the valve was kept fully open. An examination of the test results shows that the greatest difference is in the specific fuel consumption. While alcohol has a much lower heat

CENTRAL *UNIVERSAL* HOSE CLAMPS IN *Action!*



THE *Half Track* DEPENDS ON CENTRAL CLAMP-POWER

Central *Universal* Hose Clamps are supplying vital clamp-power with unfailing dependability to America's war machine.

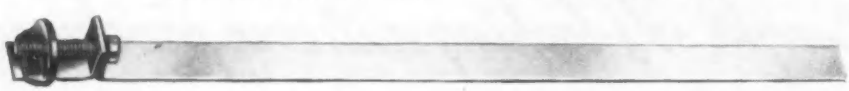
They are strong enough for every production and service requirement . . . precision built of rustproof, extra-heavy cold rolled steel . . . self-locking . . . cannot strip or loosen . . . able to withstand abnormal pressure, stress, strain and vibration . . . easier to use in hard-to-get-at places . . . quickly attached or removed without disconnecting the line.

A single length *Universal* Clamp fits hundreds of diameter sizes.

•Army and Navy combat vehicles, farm and road-building machinery, diesel and gasoline engines, and all types of radiator hose are equipped and serviced with Central Universal Hose Clamps.

SEND TODAY FOR FREE SAMPLE
When requesting sample please specify "Universal".

CENTRAL EQUIPMENT CO.
900 SO. WABASH AVE. CHICAGO 5, ILL.



HILLS-McCANNA
MAGNESIUM ALLOY
SAND CASTINGS

GIVE BODINE AIRCRAFT ACCESSORY MOTORS THAT "EXTRA" LIGHTNESS DEMANDED BY THE AIR CORPS

Here every ounce saved means much—and Hills-McCanna Magnesium Alloy Castings are playing an important part in reducing the weight of Bodine Motors to meet stringent Army Air Forces specifications.

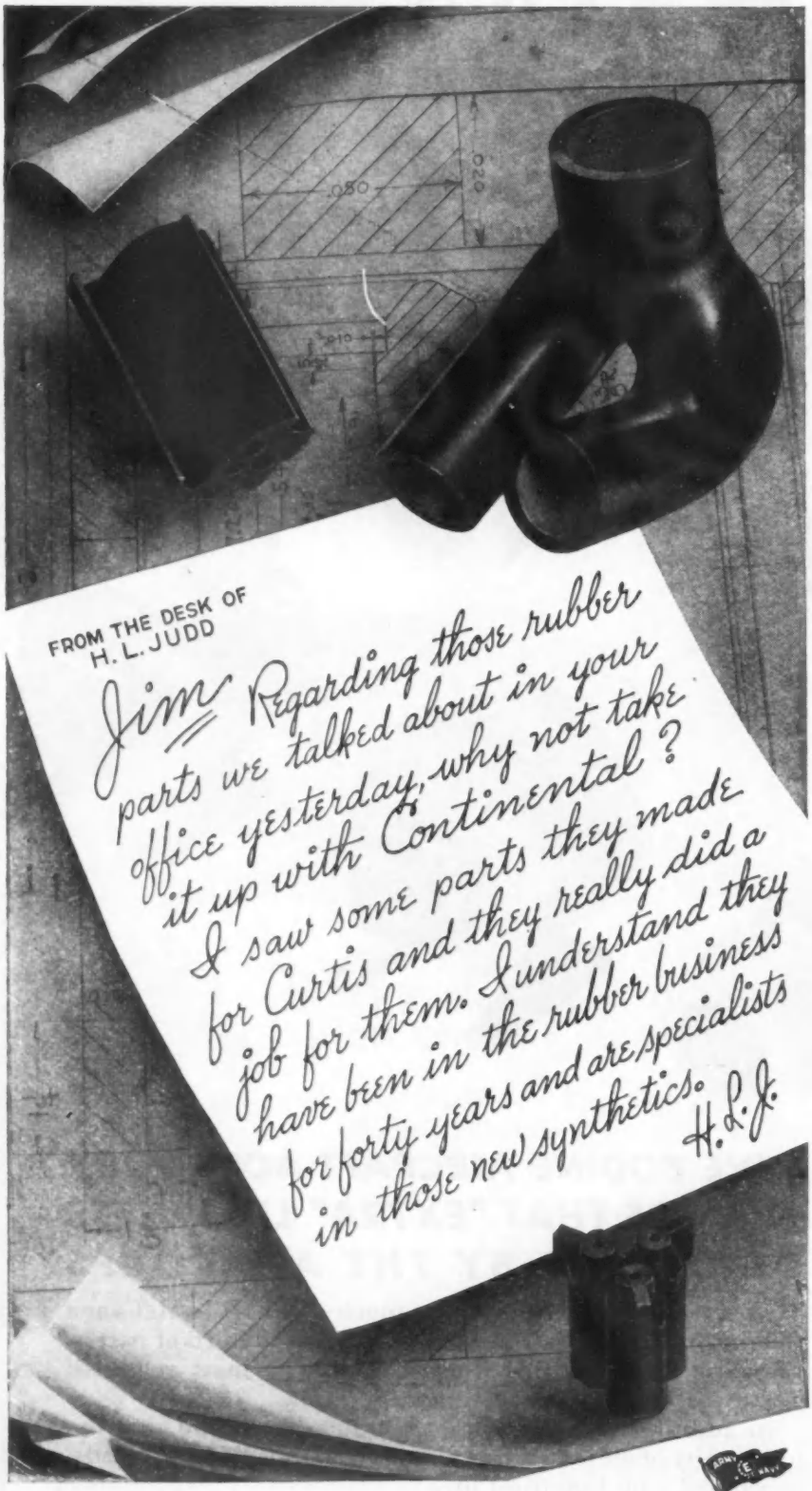
In addition to light weight, Bodine has found that the uniformity of these castings permits faster machining speeds, combined with long tool life.

Our long pioneering experience in non-ferrous alloys and the complete facilities of our foundry—patterns—laboratory—heat treating—machining are at your disposal.

Call on us relative to your projected peace time plans and products.

HILLS-McCANNA CO.
3015 N. WESTERN AVE., CHICAGO 18, ILL.

Manufacturers of
PROPORTIONING PUMPS • AIR & WATER VALVES • CHEMICAL VALVES
MARINE VALVES • FORCE-FEED LUBRICATORS • MAGNESIUM CASTINGS


FROM THE DESK OF
H. L. JUDD
Jim — Regarding those rubber parts we talked about in your office yesterday, why not take it up with Continental? I saw some parts they made for Curtis and they really did a job for them. I understand they have been in the rubber business for forty years and are specialists in those new synthetics.
H. L. J.

THE HAND OF THE SPECIALIST

BRANCHES

Baltimore, Md.	Cleveland, Ohio	Kansas City, Mo.	Philadelphia, Pa.
Boston, Mass.	Dallas, Texas	Los Angeles, Cal.	Pittsburgh, Pa.
Buffalo, N. Y.	Dayton, Ohio	Memphis, Tenn.	Rochester, N. Y.
Chicago, Ill.	Detroit, Mich.	Milwaukee, Wis.	San Francisco, Cal.
Cincinnati, Ohio	Indianapolis, Ind.	New York, N. Y.	St. Louis, Mo.

CONTINENTAL RUBBER WORKS

ERIE, PENNSYLVANIA, U. S. A.

value than gasoline, sufficient alcohol can be supplied in the mixture to heat and expand the air to the same degree as with gasoline, the result being equal power, but an increase in fuel consumption.

With alcohol and butanol the power output undoubtedly was affected by the fact that the mixture distribution was poor, and if this can be corrected, lower specific consumptions may be expected. Besides, the compression ratio used with alcohol was limited to that considered correct for gasoline, and if the highest useful compression ratio were used, the specific consumption with this fuel would be lower.

In order to obtain true comparative results with different fuels, it is necessary to run tests to establish the highest useful compression ratio in an engine in which all conditions except the compression ratio can be held constant, and at the National Bureau of Standards a single-cylinder test engine was used for this purpose. In the tests the compression ratio was adjusted until there was just a trace of knock or detonation, and this point was reached with gasoline when the compression ratio was 5.11, and with 190- and 200-proof alcohol when it was 9.91. This increase in the allowable compression ratio with alcohol permits of a higher thermal efficiency with that fuel.

At lean mixtures giving 99 per cent maximum power the thermal efficiency with gasoline as fuel ranged between 26 and 27 per cent, while with the various substitutes it ranged between 31 and 33.5 per cent. The maximum power developed with the substitute fuels was 26 per cent greater than with gasoline. Results still more favorable to alcohol might be obtained in engines in which the combustion chamber and valve design, and the spark timing were specially adapted to the requirements of that fuel.

When alcohol is to be used in regular service, it will be necessary to add a more volatile fuel to facilitate starting, and as ether can be cheaply manufactured in alcohol distilleries, if a little extra equipment is installed, it may well become the "starting additive." It is known that ether by itself promotes detonation, and its addition to alcohol would be expected to lower the antidetonating quality of the latter. The effect of ether additions to alcohol on the minimum starting temperatures is shown by Table VI. With the various additions given in the table, at temperatures above the corresponding minimum, a start is obtained almost immediately, and smooth operation in about 30 seconds.

The Bureau of Standards made a series of tests for the octane rating of various blends of ether and ethyl alcohol. A sufficient number of blends were rated by both the A.S.T.M. motor method and the C.F.R. research method, to define accurately the relations between octane number and the composition of the ether-alcohol mixtures. Table

factors AFFECTING THE FUNCTIONING OF OIL SEALS

1. Surface speed of the shaft to be sealed.
2. Operating temperature of the bearing.
3. Maximum difference in pressure on the two sides of the seal due to hydrostatic head and/or expansion of air and liquid inside the mechanism.
4. Possible necessity for excluding moisture and foreign matter from the bearing housing.
5. Character of the lubricant or other fluid to be sealed.
6. Possibility of sealing member contact with harmful chemicals.
7. Necessity for use of non-corrosive metals in closure.
8. Eccentricity of shaft.
9. Surface finish of the shaft.
10. End play of the shaft.
11. Direction of the shaft (vertical, horizontal, or inclined).
12. Friction load, especially in the case of preloaded bearings.
13. Distance from the drive to the bearing being sealed.
14. The accessibility of the recess in which seal fits and direction of assembly over shafts and hubs.
15. Method of lubrication.

All these factors require consideration. Don't take a chance.

Take Advantage of the Wide Experience of CHICAGO RAWHIDE ENGINEERS in working out your Sealing Problems

CHICAGO RAWHIDE MANUFACTURING CO.

1310 ELSTON AVENUE • CHICAGO, ILLINOIS

PHILADELPHIA • CLEVELAND • NEW YORK • DETROIT • BOSTON
PITTSBURGH • CINCINNATI

65 Years Manufacturing Quality Mechanical Leather Goods Exclusively and now Sirvene Synthetic Products

VII gives the results obtained with the various blends.

Within the range of ether-alcohol ratios required for starts down to minus 20 F (25 per cent ether), the mixture is stable and the octane rating is good.

With L-head engines it may be difficult to make the compression space sufficiently small for the maximum allowable compression ratio with alcohol. But as cylinder heads must be modified in any case—if the high anti-knock value of alcohol is to be taken advantage of—in a new alcohol engine we might consider an F-head design, that is, a cylinder with the intake valve in the head and the exhaust valve in a side pocket. In a cylinder of this type it is possible to provide large valves, and the inlet valve, moreover, opens directly into the cylinder. In the combustion chamber of such a cylinder the space occupied by the part of the charge last to burn has a very large surface-to-volume ratio, or a large quenching area, which tends to prevent detonation. If, in addition, the best position of the intake valve from the anti-detonation standpoint is studied, it should be possible to obtain with an engine of this type a b.m.e.p. of 130 psi without appreciable roughness.

Bearings
for
Present or
Post-war
Plans
Let us work out with your engineers the design, application and service of any type anti-friction bearing on which you may need specialized advice. Our research into the operation and performance of bearings—their stress, load and service conditions—qualifies us to be helpful to you in governing your design of Ball and Roller bearings. Thirty-two years engineering experience in the making of high quality, smooth precision, heavy duty, special design and standard bearings over 100 MM. O.D.
Write or phone for new Catalog giving full particulars.
Equitable
EQUITABLE BEARING CO., Inc.
4635 COTTAGE GROVE AVE.
CHICAGO 15, ILL.

In Table VIII are given the heats of combustion of the various test fuels, while Table IX gives the heats of vaporization of one pound of gasoline and of equivalent quantities of two grades of alcohol, together with the drop in mixture temperature caused by the evaporation of the fuel. From Table IX it can be seen that five times as much heat is required to vaporize the 95 per cent alcohol as to vaporize gasoline. This ratio will be reduced when the distribution is improved, but it will still be 3.5. In the course of the tests at Washington last summer, with an atmospheric temperature of 90 F, it was observed that the intake manifold was covered with frost while the car was being driven. It is therefore quite likely that with alcohol no automatic heat control will be required.

Corrosion and wear tests also were carried out by the Bureau of Standards, a total of six engines of three different types being put through a succession of cycles of alternate idling and open-throttle operation. The data collected in these tests—which extended over 61 engine-weeks—clearly indicated that there is less wear with alcohol than with gasoline. Comparative wear figures for the front and rear cylinders of a particular engine are given in Table X.

Table X

Cylinder-Bore Wear

Cylinder No. 1	
Gasoline	.064
Ethyl 200-proof	.034
Gasoline	.070
Ethyl 190-proof	.032
Cylinder No. 6	
Gasoline	.013
Ethyl 200-proof	.013
Gasoline	.025
Ethyl 190-proof	.026

In this particular engine, the corrosion in road service is a maximum in the front cylinder, and it will be seen that with alcohol the front-cylinder wear is only about half as much with alcohol as with gasoline. In the rear cylinder the wear was substantially the same with the two types of fuel, and very much smaller than in the front cylinder. This seems to indicate that wear in the rear cylinder in this engine is due solely to abrasion.

Dryer for Blue Prints

For "overall drying" of blue prints or black and white prints, Peck and Harvey, Chicago, has produced a compact electrically heated dryer in two sizes, handling prints of 26-in. and 44-in. widths.

In addition to standard heat regulation as provided, the "B-8" dryers are also equipped with variable speed drive motors and controllers. This permits instantaneous speed changes over a range of 6 in. to 3½ ft per minute, thus accommodating all types of work under various drying conditions.

Sandy Hook Lighthouse, built in 1764.

ON THE BEAM-
for nearly two centuries

Tobe Capacitors, too, are "on the beam"—giving years of dependable service . . . for, at Tobe, *long life* is as integral a specification as the dimensions themselves. That is why, with millions of Tobe Capacitors operating under all conditions, "returns" are practically negligible. Continuation of this enviable record rests on long, specialized manufacturing experience—intensive inspections — and constant research. Illustrated below is the Tobe OM-Capacitor. This capacitor is a mineral oil impregnated unit in a streamlined drawn container, hermetically sealed. The hold-down bracket permits the use of either inverted or upright terminals, with wiring underneath or on top of chassis. You will find Tobe engineers ready to cooperate on your own capacitor problems. Why not inquire now?

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

LONG LIFE ASSURED

This new separate mounting is stronger and helps prevent leaks caused by breaks in can. This outstanding Tobe design takes the minimum amount of space.

SPECIFICATIONS

OM-CAPACITORS

TYPE	OM-*
RATINGS	.05 to 2.0 mfd. 600 V. D. C. .05 mfd. to 1.0 mfd. 1,000 V. D. C.
STANDARD CAPACITY TOLERANCE	20%**
TEST VOLTAGE	Twice D. C. rating
GROUND TEST	2,500 Volts D. C.
OPERATING TEMPERATURE	-55° F to 185° F
SHUNT RESISTANCE	.05 to 0.1 mfd. 20,000 megohms .25 to 0.5 mfd. 12,000 megohms 1.0 to 2.0 mfd. 12,000 megohms
POWER FACTOR	At 1,000 cycles—.002 to .005
CONTAINER SIZE	Width ⅝", length 1 5/16", height 2¼"
MOUNTING HOLE CENTERS	1½"

MIDGET OM-CAPACITORS

TYPE	OMM-*
RATINGS	.05, .1 and 2 x .05 600 V. D. C. -.05 x .1 1000 V. D. C.
STANDARD CAPACITY TOLERANCE	20%**
GROUND TEST	2,500 V. D. C.
OPERATING TEMPERATURES	-55° F to 185° F
SHUNT RESISTANCE	20,000 megohms
POWER FACTOR	At 1,000 cycles—.0075
CONTAINER SIZE	Width ⅝", length 1 5/16", height 1 11/64"
MOUNTING HOLE CENTERS	1½"

*Data sheets showing complete code number for units having a specific capacitance value and voltage rating available on request. **Other tolerances available.

A SMALL PART IN VICTORY TODAY...A BIG PART IN INDUSTRY TOMORROW

• *This is the story of one of the many contacts made by Square D Field Engineers which have resulted in increased production or reduced costs.*

Our production was taking it —on the nose!

A Southern plant was forging noses for bombs. Frequent breakdowns of a forging machine (an average of three shutdowns per shift) were slowing production. In terms of completed bomb noses, the loss amounted to 18 per day. A Square D Field Engineer was called in. He traced the trouble to failure of the electrical control —remedied it, at negligible cost, by specifying correct and adequate control equipment. But he didn't stop there. He suggested a means of switching from remote to "finger tip" control which added another substantial production boost. Total increase—more than 4,000 bomb noses per month.

Let a Square D Field Engineer Help You

In the face of today's manpower shortage, peak efficiency of your electrical control and distribution system is vital. It will be equally important in the highly competitive and narrow-margin years ahead. Now is the time to profit most by the counsel of your nearest Square D Field Engineer. This service is available through Square D branch offices in nearly 50 principal U. S. and Canadian cities.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Union Demands

(*Continued from page* 48)

Wagner Act, such employees will be entitled under strict construction of the law to join unions and to enjoy the same benefits accorded other unions for redress of grievances before the National Labor Relations Board.

Management contends that foremen are agents of management and that they comprise the first step in grievance procedure. It also has introduced into the testimony considerable evidence to refute FAA claims that foremen are paid less than the men working under them.

Despite strenuous objections by labor and management, the WMC on July 1 put into effect its nationwide priority referral plan which gives the USES full control of labor placement and makes possible channeling of workers into jobs in "urgent" industries.

In Detroit, the Labor Management Committee has adopted a resolution calling for relaxation of restrictions with labor representatives terming the plan a labor draft in all but name and management charging that the order "hogties" both labor and management. John L. Lovett, management representative, has announced that request has been made for exemptions for all firms having labor priorities. Victor Reuther, representing labor, has suggested extension of the 48 hour week to communities adjacent to Detroit to release additional male workers for Detroit industries.

The priority referral plan applies to all employers of 50 or more persons and covers all full time male workers 17 or over and in some areas applies also to women. Companies on the WMC priority list may hire directly any male worker who has a release from the WMC or who is referred to them by the USES. Both worker and employer retain freedom of choice since the employer is not required to hire the applicant nor is the latter compelled to take the job, but may look elsewhere for employment with another priority employer. In less essential industries, replacements will be available only when top urgency employers' needs are filled.

Glover Appointed Deputy Director

Frederic S. Glover, one-time president of Reo Motors, Inc., and Timken-Detroit Axle Co., has been appointed deputy director of the Automotive Division of the Equipment Bureau of WPB. He has been with WPB since December, 1941, serving as chairman of the Joint Optics Committee of the WPB and Army and Navy Munitions Board for the past 13 months. Glover served as a colonel in World War I in charge of procurement for the Motor Transport Service of the U. S. Army.

After 7997 hours in service . .

no measurable wear on

PORUS-KROME*

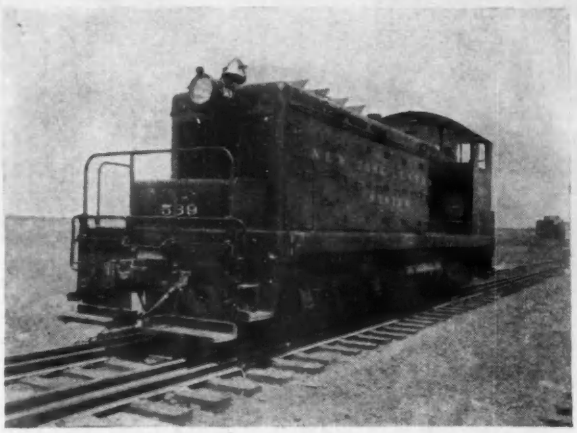


Photo courtesy of the New York Central System

In a test being made in a Diesel switching locomotive of the type shown above, no measurable wear was noted on PORUS-KROME cylinder surfacing after 7997 hours of operation . . . approximately one year in regular switching service.

This is another bit of evidence in the general experience that PORUS-KROME, applied to cylinders by the Van der Horst process, multiplies cylinder life 4 to 20 times. It makes the engine more reliable, too, because it eliminates a number of shut-downs for cylinder reboring or replacement . . . keeps the engine in operation many more hours of continuous running.

Whether it is used in engines of locomotives, or busses, or ships, or planes, or any other internal combustion engine, PORUS-KROME reduces to a minimum scoring, scuffing, ring feathering, and the risk of piston seizure. Let Van der Horst engineers show you how PORUS-KROME will lengthen the life of the cylinders in your engines, and lower the cylinder and ring maintenance cost.

* PORUS-KROME is pure chromium, applied by the Van der Horst process that produces pores to hold oil. It reduces wear, corrosion and scuffing, and greatly multiplies engine life when used on cylinder walls, or other bearing surfaces. May be obtained in Van der Horst plants or by license agreement.

PORUS - KROME

VAN DER HORST

Good for the Life of your Engines

VAN DER HORST CORPORATION OF AMERICA

AN AFFILIATE OF DRESSER INDUSTRIES

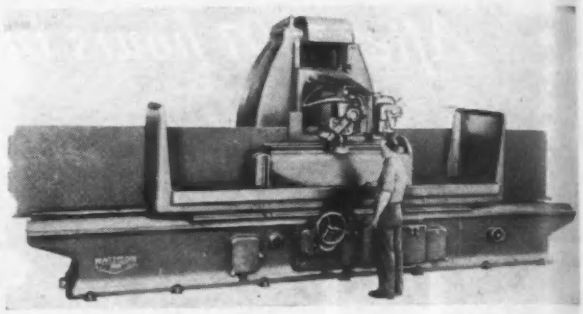
OLEAN • NEW YORK
CLEVELAND 11 • OHIO

New Production Equipment

(*Continued from page* 35)

grinding operations. For dry operation coolant unit is omitted and a connection for exhaust provided.

MATTISON MACHINE WORKS, Rockford, Ill., has developed a new type grinder for finishing tables, slides, saddles, heads, turrets and other parts having angular machined ways or surfaces. Through the use of this machine, manufacturers are able to eliminate the hand scraping operation, as well as being able to finish parts having hardened ways. The grinder also can be used for grinding flat parts, where it is not necessary to remove an excess amount of stock.

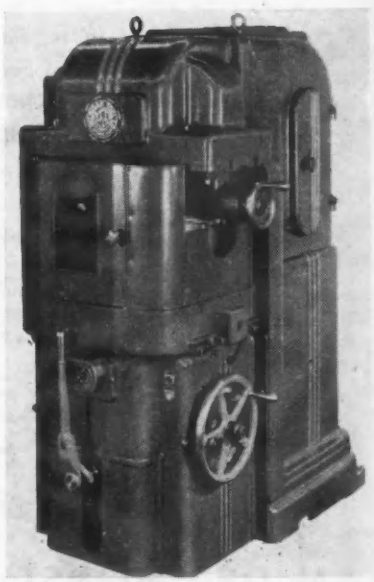


Mattison precision vertical - spindle way grinder

The grinding head unit is mounted on a dovetail casting slide, which is part of the vertical slide assembly. This slide is adjustable horizontally by hand, or rapid traverse by electric motor drive. The head unit can be swiveled 60 deg. A graduated circle permits rough setting of grinding unit to desired angle. Final adjustment is made by means of sine bar or checking gauge. A power-driven truing device is furnished for dressing wheel to desired angle.

AN IMPROVED line of its "860" series rotary crossed-axis gear finishing machines is in production at Michigan Tool Company, Detroit, Mich. The line comprises four models, the 860 for shaving narrow face and shoulder gears by the "underpass" method; the 860-B for shaving wider faced gears by the "transverse" shaving method; the 860-A, in which both the "underpass" and "transverse" shaving meth-

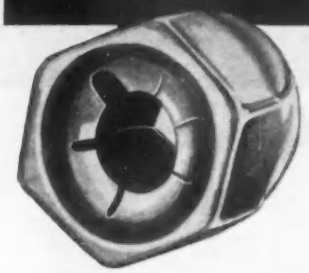
(*Turn to page* 96, *please*)



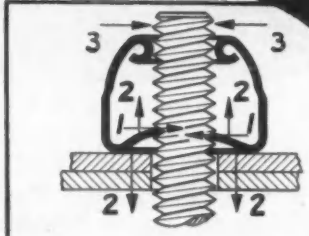
Series 860 gear finishing machine

NEW TYPE 6NAO SELF-LOCKING PALNUTS

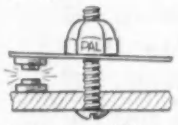
With the TRIPLE-GRIP



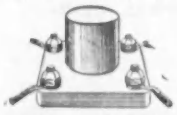
The new Type 6NAO Self-Locking Palnut may be used 2 ways. Used as a fastening, the full triple grip keeps parts tight under vibration, without need of lockwashers. Used as a regulating nut, the third gripping action (3-3) locks it firmly anywhere on the screw. (See typical uses herewith.)



When the 6NAO Palnut is tightened, its arched, slotted jaws grip the bolt like a chuck (1-1), while spring tension is exerted upward on the bolt threads and downward on the part (2-2), securely locking both. A third grip is exerted around the top of the bolt by spring tension at 3-3.



Used as regulating nut



Fastening electrical terminals

Type 6NAO Palnuts are single thread, tempered spring steel locknuts; light in weight, low in cost; easily, speedily applied. Send details of your assembly for samples and suggestions. Write for new data sheet and copy of Palnut Manual No. 2, giving information on all types of Self-Locking Palnuts.

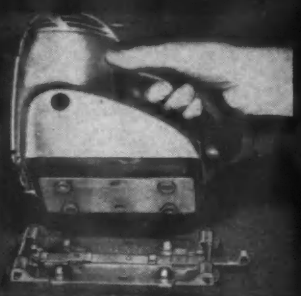
THE PALNUT COMPANY
60 Cordier St., Irvington 11, N. J.

Self-Locking PALNUTS

Faster... More Precise...

AND MORE ECONOMICAL

THAN HAND SANDING!



Instantly detatchable sanding pad holds ⅓ sheet of standard abrasive taut and secure. No abrasive wasted. As many pads as desired, loaded with the same or different grades of abrasives assures uninterrupted sanding operations.

STERLING

1000 PORTABLE ELECTRIC

SANDER

Get your sanding jobs done faster . . . produce a smoother, more uniform surface on wood, metals or plastics . . . and make a 25% to 75% savings in time and abrasives!

Superior to both hand and ordinary machine sanding, the Sterling 1000 efficiently uses the entire abrasive surface.* Abrasive grains work in all directions with an orbital motion and weak sections of the grains are progressively stressed and fractured bringing new sharp cutting edges into use. The Sterling 1000 sands (coarse or fine), laps and polishes. Vibrationless, light in weight, easy to operate! Many other important features described in new booklet, "Orbital Motion". Write for it now!

**Sterling sanding eliminates costly discarding of partially used abrasive paper . . . orbital motion principle assures more sanding "mileage"!*

For air-driven sanding ask about the Sterling Speed-Bloc Sander

STERLING TOOL PRODUCTS CO.

385 EAST OHIO STREET • CHICAGO 11, ILLINOIS

Los Angeles and Toronto

AAC
Products
AIRCRAFT
ENGINEERED POWER
Burbank, Calif.

A Constellation is composed of many Stars

THERE'S a new constellation in the skies, a star of stars... a new master of the heavens. This great ship, conceived by TWA... built by Lockheed, holds a mighty promise, a promise of tremendous developments in peacetime air transport. We are proud to share in its record-breaking glory and in its promise... proud that AAC Hydraulic Controls are among the many stars which make up this Constellation. These precision units are another mark of AAC leadership in Engineered Power Controls... in the air, on land, and on the sea.

(P-74)

POWER CONTROLS DIVISION

BURBANK, CALIFORNIA

FT ACCESSORIES CORPORATION

VER CONTROLS • PRECISION RADIO *and* ELECTRONICS

Kansas City, Kans. Cable Address: AACPRO

If You Use ...or Plan to Use

SOLVENT DEGREASERS

YOU'LL WANT A COPY OF *this* NEW BOOK

Here is a clear, concise description of modern chlorinated degreasing methods which are used in every type of industrial cleaning operation. One section of this book covers in complete detail how solvent losses can be reduced to provide the greatest economy in metal cleaning.

If you haven't received your copy, write for it on your company letterhead. There's no charge or obligation.

DETREX CORPORATION

13001 HILLVIEW AVENUE • DETROIT 27, MICHIGAN

HELP SPEED VICTORY
BUY MORE WAR BONDS

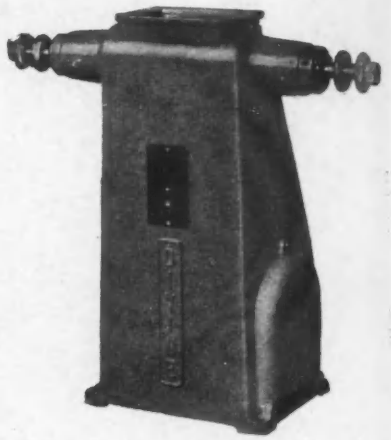
ods are provided; and the 860-C for shaving of internal gears.

Among improvements made in the machines are the use of Cone-Drive gearing; provision of increased power to form a reserve for special jobs; improved facilities for curve-shaving; greater flexibility in application of the same machine to different jobs; and reduced maintenance through a "one-shot" automatic lubricating system.

DIVINE BROTHERS, Utica, N. Y., are introducing a light-duty lathe for small parts polishing and burring.

The VJ lathe is a V belt-driven unit, with motor sizes up to 3 hp., and spindle speeds to a top of 3850 rpm. The lathe may be used with taper spindle extensions for bob work.

Two sealed-for-life spindle bearings



Divine polishing lathe

eliminate the need for periodic lubrication of spindle bearings. The spindle is V belt-driven from a NEMA standard motor. An adjustable motor base provides V belt adjustment. The starter is mechanical push-button type with thermal overload relays for motor protection.

THE Model RC precision boring machine, now in production at the Century Engineering Company, Los Angeles, Cal., is designed to bore holes up to approximately 2½ in. in diameter and lends itself to special applications and set-ups. The working surface of the table is 6¼ in. by 33½ in. The

Century model RC boring machine

PERFORMANCE

In battle—where performance really counts—Long oil coolers, radiators and clutches are doing their share to bring Allied victory. Thoroughly designed to withstand the severest conditions in pressure, vibration, and temperature ranges, Long products will assure the same fine performance in postwar vehicles.

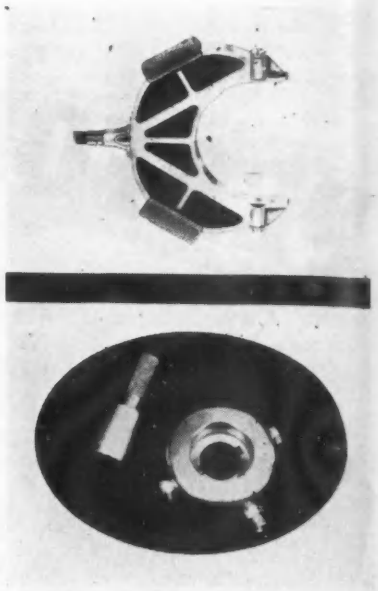
LONG MANUFACTURING DIVISION, BORG-WARNER CORPORATION
DETROIT 12, MICHIGAN • WINDSOR, ONTARIO

LONG
CLUTCHES • RADIATORS • OIL COOLERS

table has two 11/16 in. wide tee slots running the full length and a coolent trough around the outside edge. The ways are provided with an automatic oiling system.

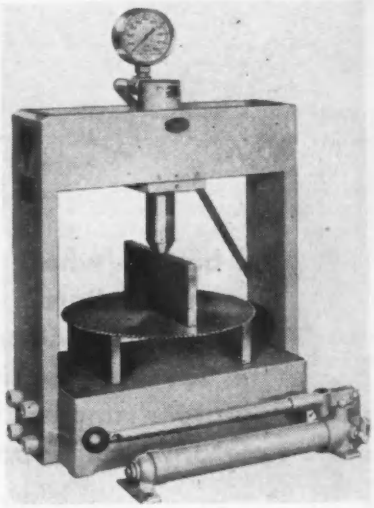
The centerline of the spindle is 6⅝ in. above the table. A three-step pulley operates the spindle at 650, 1,300 and 2,450 rpm. when using 60 cycle current. All controls are located in front of the machine. The boring feeds are variable through a wide range and are controlled by a metering valve. A second metering valve can be supplied to control the return movement of the table so that the forward stroke can be used for a semi-finish cut and the return stroke for finishing. The feed mechanism operates on 90 to 125 lb. of air.

THE Metrical Laboratories, Inc., Ann Arbor, Mich., is making precision external indicating gages, using the flow of air as the measuring medium and operating in conjunction with the Metricator instrument. These gages can be made in either the indicating ring or indicating snap gage type, depending on the size of the external diameter to be measured. The maker claims that size variations as small as .000025 in. can be readily detected and for parts requiring an extreme degree of accuracy, the amplification can be sufficiently increased so that parts can be sorted into groups of .000010 in. size difference.



Metrical precision external indicating gages

A NEW laboratory press has been added to the line of presses offered by Anderson Bros. Mfg. Co., Rockford, Ill. This unit has a total capacity of 20 tons, or 40,000 lb. It has a stroke of 5 in. The table is 12 in. by 20 in. and is accurately machined. Power is derived from a hydraulic hand pump.



Anderson laboratory press

The press as illustrated does not show a table or stand; however, one can be furnished to suit customer's requirements. In addition to the use as a laboratory press, this unit can be used for many production straightening jobs, such as large sprockets, gears, plates, etc. The weight of this new press is 400 lbs.

(*Turn to page* 100, *please*)

HERBRAND
DROP FORGINGS
--any size or shape up to 200 lbs.
THE HERBRAND CORPORATION • Fremont, Ohio
Drop-Forged Tools Since 1881

HAYES WHEELS AND EXPANDER TUBE BRAKES ON THE B-29

—AND ALL

U. S. 4-ENGINE BOMBERS

Western Representative: Airsupply Co., 5959 W. 3rd St., Los Angeles

HAYES INDUSTRIES, INC. JACKSON, MICH., U.S.A.

HAYES

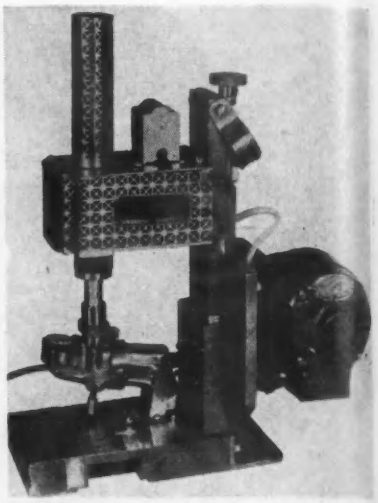
AIRCRAFT

WHEELS AND BRAKES

TOOL tips cast from Haynes Stellite cobalt-chromium-tungsten alloy are available for shops desiring to fabricate their own metal-cutting tools. They are made by Haynes Stellite Company, Kokomo, Ind. Metal-cutting tools made by brazing these tips to steel shanks are recommended for jobs employing tools of large cross sections or tools that are bent or offset, or in tool holders which make the use of solid tools impractical.

Ten standard shapes of tool tips are available, in each of ten standard sizes, cast from either 98M2 or Star J-Metal alloy. Each has the joint faces (bottom and one end) bronze-tinned for brazing. Standard tips can also be furnished without the bronze coating, if desired. Stock is allowed on standard tips for finish to nominal size.

THE hardness tester and certifier developed by Glenn L. Martin Company, built by York Electric Tool Company, York, Pa., is said to answer a specific need in any industry using aluminum, aluminum alloys, plastics, and similar materials. This device will electrically certify and mark each piece being tested. Materials not being marked are rejected as not meeting specifications.



Hardness tester made by York Electric Tool Co.

This machine has facilities to accommodate certification die, and inspectors die, in same operation. The testers' stamp, or mark, also includes U. S. Government certification.

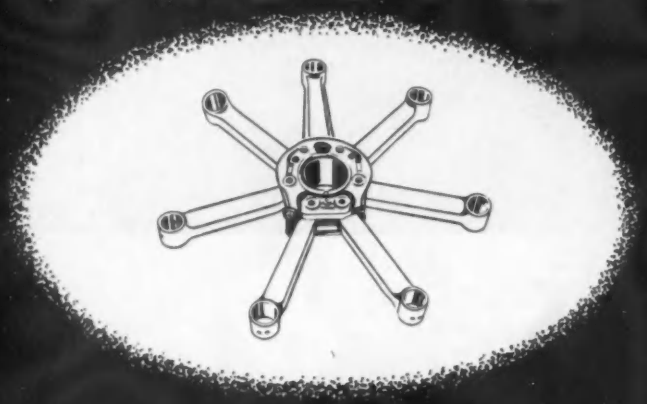
ALLISON TOOL & ENGINEERING COMPANY, Los Angeles, Cal., has just brought out the new Allison electrode holder for welding. It is made in two models; Model A, which is a 19-oz. unit built to handle heavy 300-500-amp. work, and Model B, a 6¼-oz. holder for lighter 200-amp jobs.

The new Allison electrode holder is moulded of a high heat resistant plastic to insure full insulation and to eliminate all possibility of arcing due to slag, moisture, or contact with grounded surfaces. It incorporates only three main parts—the handle, cable connector, and the tip.

A COMPLETE line of precision gauges to meet standard or special gauging requirements is offered by the Crescent Tool and Die Company, Lincoln Park, Mich. Plug, ring, flat plug, profile, flush pin, snap and build-up gauges are available in a full range of standard sizes and tolerances. Standard gauges are built to American Gauge Design Committee specifications. Special gauges are manufactured to purchaser's blueprints.

Crescent gauges are offered in any of three materials, steel, chromium plate, or carbide, according to the demands of the particular job. Chromium plate and carbide are designed for long production runs or for use with highly abrasive materials as they offer greater resistance to wear.

BETTER BEARINGS *with* INDIUM



New records for motor bearings life—several times pre-war's best—are being turned up despite the tight situation in white metals. In INDIUM, manufacturers found the answer.

By plating INDIUM onto the contact surface of the bearing and then diffusing it, metallurgists are able to impart a high concentration of INDIUM just where needed. The hardened surface of the bearing proved far more resistant to wear, oil-corrosion, and softening, without loss of its anti-friction value.

Several builders of aircraft engines, Diesels, and motor trucks are putting this life-giving element in bearing metals for their power units. Why not see what it can do for you?

ARMY E NAVY

INDIUM CORPORATION OF AMERICA

49

THE INDIUM CORPORATION OF AMERICA

UTICA, N. Y.

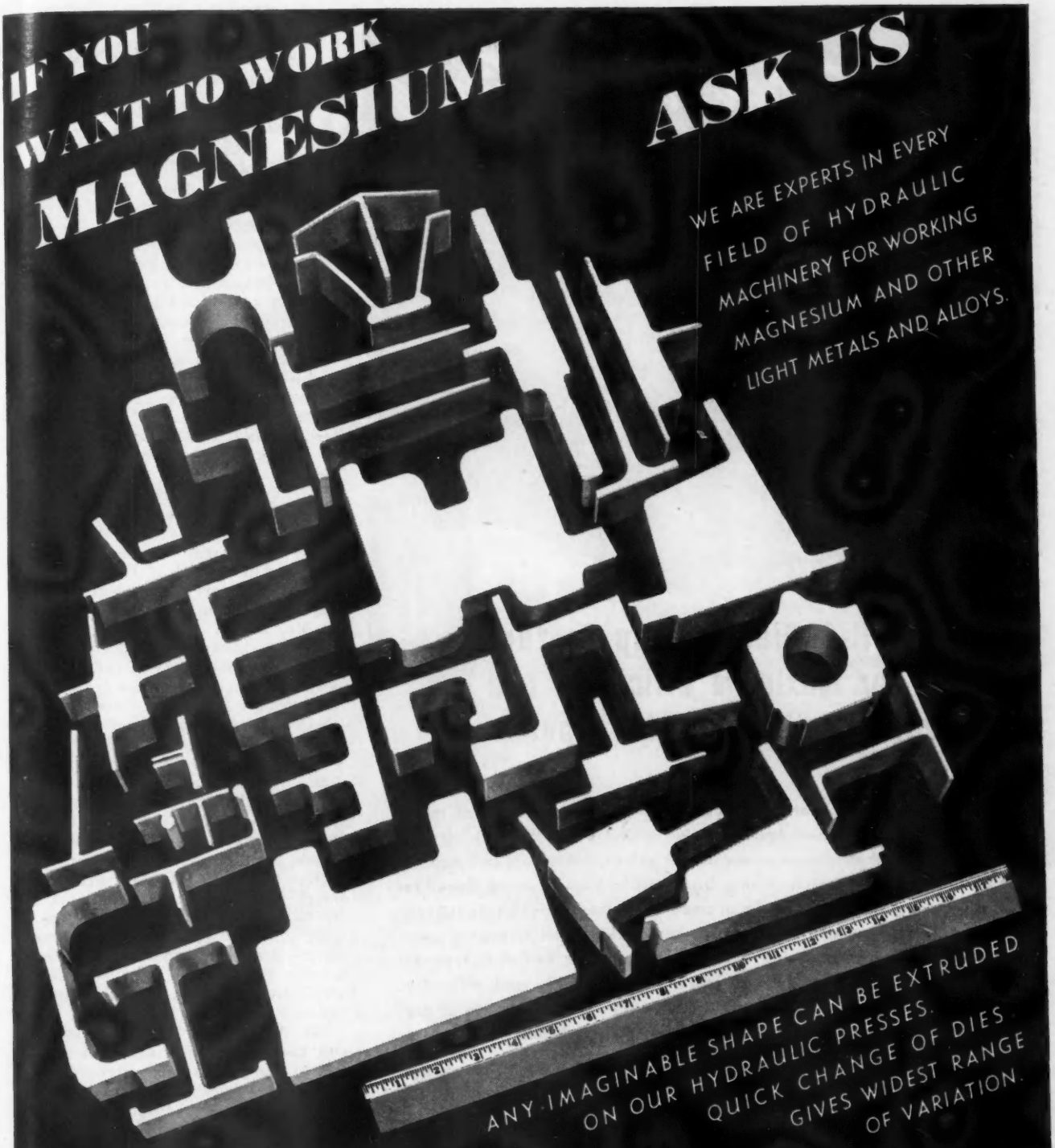
New York Office: 60 East 42nd Street, New York 17, N. Y.

7-10-6

Save and Win with War Bonds

IF YOU WANT TO WORK MAGNESIUM ASK US

WE ARE EXPERTS IN EVERY FIELD OF HYDRAULIC MACHINERY FOR WORKING MAGNESIUM AND OTHER LIGHT METALS AND ALLOYS.



ANY IMAGINABLE SHAPE CAN BE EXTRUDED ON OUR HYDRAULIC PRESSES. QUICK CHANGE OF DIES GIVES WIDEST RANGE OF VARIATION.

HYDROPRESS · INC.

ENGINEERS CONTRACTORS

HYDRAULIC PRESSES · ROLLING MILLS

STRETCHERS · PUMPS · ACCUMULATORS

570 LEXINGTON AVENUE · NEW YORK · N. Y.

Automatic Fuel Injection Timing

This Ex-Cell-O Diesel Pump Feature Provides for Maximum Efficiency and Fuel Economy at All Engine Speeds

For variable speed applications such as Diesel-powered vehicles and motor ships, the automatic timing feature in the Ex-Cell-O type KB fuel injection pump provides for maximum power output and minimum fuel consumption by advancing fuel injection timing according to engine speed. Speed-responsive timing materially results in smooth, flexible operation throughout the operating range and increases the service life of vital engine parts. For applications not requiring automatic timing, the Ex-Cell-O type KD pump provides the same high degree of dependability and efficiency. Both of these war-proved pumps reflect Ex-Cell-O's quarter century of precision production and years of experience in the Diesel field.

The Ex-Cell-O nozzle is a worthy complement to Ex-Cell-O pumps, specifically designed for efficiency, dependability and trouble-free service.

For complete information, engine builders should address Diesel Division, Ex-Cell-O Corporation, Detroit 6, Michigan.

XLO
EX-CELL-O for PRECISION

EX-CELL-O
DIESEL FUEL INJECTION
EQUIPMENT
EX-CELL-O CORPORATION · DETROIT

Moran Heads the Automotive Division

(*Continued from page* 48)

Treasury Disposal Unit has been called upon to handle has been the sale of trucks which have become surplus to the needs of the military services. These trucks are being sold on a regional basis with the cooperation of ODT, AAA and other organizations.

They are being sold through the regional offices of the Treasury Procurement Division and this procedure will continue to be used in the disposal of all automotive surpluses. Mr. Moran said that although he was building a new staff and setting up policies his group would "dovetail with the existing Treasury Procurement set-up."

The new Automotive Division director also said that if a large quantity of trucks or other automotive equipment was available at a particular place it would be sold on the spot and Treasury agents would be moved in to handle the sale rather than move the material to the nearest regional office.

During the month of June more than 3000 trucks were disposed of to essential users, according to figures quoted by Mr. Moran. Over 1000 were sold in Texas to aid in crop harvesting. Trucks are sold in "as-is" condition and within OPA ceiling prices.

Passenger vehicles, maintenance equipment, tires and combat vehicles have not been available in sufficient quantities to have raised any real problem.

While only negligible quantities of parts have been available Mr. Moran's plans for disposing of parts surpluses should be of interest to the entire automotive industry. He said that an attempt will be made to get "parts into the hands of the manufacturers for redistribution." The Treasury Department has already experienced moderate success in selling new goods, in other lines, back to the original manufacturers.

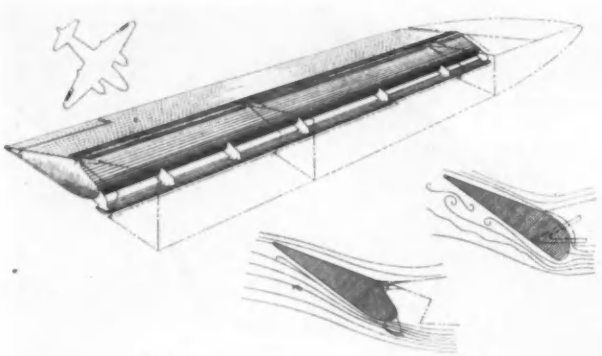
Mr. Moran said that damaged vehicles have been providing small quantities of parts to relieve current shortages. These vehicles are in a different category, but are sold in much the same manner as are serviceable vehicles. For example, in a recent sale of several hundred trucks at one particular location, about 20 per cent af the total number were unserviceable, but were sold for parts replacement purposes and not highway use.

Mr. Moran comes to his position in the Treasury Department with a record of 25 years active work in the industry and undoubtedly this experience will stand him in good stead in disposing of some portion of the huge amount of automotive equipment purchased by the armed services. He began as an automobile salesman in 1919 and is now head of his own firm in Pittsburgh, also past president of the Pittsburgh, Auto Dealers Association and a director of the Pennsylvania, Automotive Association.

AEROSCREW

DRILLED HEAD BOLTS,
THREADED TAPER PINS,
HEXAGON HEAD BOLTS, ROD ENDS,
CLEVIS BOLTS *and* PINS
FILLISTER *and* WASHER HEAD SCREWS,
TAPER PIN WASHERS

AERO SCREW COMPANY
19th AVE. at 12th ST., ROCKFORD, ILLINOIS



van Zelm Aileron

Permits Shorter Span and Longer Flaps

A NEW type of aileron developed by William D. van Zelm of the Engineering Dept. at The Glenn L. Martin Co. is reported to supply the same degree of rolling moment as the conventional Frise aileron with a 35-45 per cent reduction in span and permits considerable lengthening of the wing flaps, thus increasing the load capacity that makes possible a shorter take-off and lower landing speed. It also reduces the drag caused by the gap with the conventional aileron, tends to prevent ice formation in this gap, and is said to be extremely simple to fabricate. As yet the new aileron has not been incorporated in Martin airplanes due to the design changes and retooling required, but it has been successfully test-flown on an experimental B-26 Marauder and will be built into postwar models.

Studies revealed that the projection caused by the balance portion of leading edge of the aileron created a turbulence in the air beneath the aileron resulting in a loss of effective roll and an increase in control force for angles of more than 15 degrees up. To overcome this obstacle the new aileron incorporates an auxiliary airfoil in combination with a seal closing the gap between trailing edge and aileron which smooths the air under the aileron when in an up position, and at the same time balances the aileron with a force in the direction of roll, permitting twice as much upward deflection as with the conventional type. The auxiliary airfoil or slat is extruded from aluminum alloy and is attached to the front or leading edge of the aileron with metal clips or plates. In the neutral and down positions it fits into a cut-out section of the trailing edge of the wing. It does not add weight since it replaces the metal weights used in former ailerons to bring the center of gravity forward of the hinge point to prevent flutter.

The improved aileron assembly employs a top hinge for attaching aileron to trailing edge. This removes all restrictions on upward deflection while still permitting a downward deflection of up to 15 degrees, the same amount provided by the conventional center-hinged aileron, due to the cut-out section in the trailing edge. The top hinge also simplifies the problem of sealing the gap between aileron and trailing edge—an essential feature of the design necessary to provide smooth air flow. The seal itself is a spring metal strip attached to the top of the aileron and running under a bulb section at the wing trailing edge. Since contact with the trailing edge is very close to the hinge line, friction is held to a minimum.

What Would You Do About A Problem Such As This?

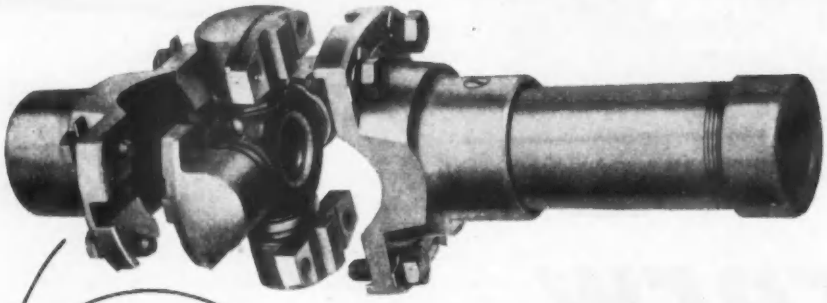
INTER-OFFICE MEMO:
The universal joints in our 194X model must have fewer parts and less weight—

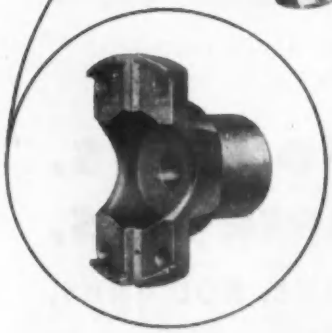
If You Specify a

MECHANICS

Roller Bearing

UNIVERSAL JOINT





—you will eliminate the need for companion flanges — without sacrificing ease of assembly. If full advantage of the MECHANICS design is used, a very substantial weight reduction can be accomplished — at a point where simple design, minimum weight and faster assembly will be vital to post-war models.

MECHANICS

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corporation
2020 Harrison Avenue, Rockford, Ill. Detroit Office, 7-234 G. M. Bldg.

FOR YOUR POSTWAR PRODUCTS . . .

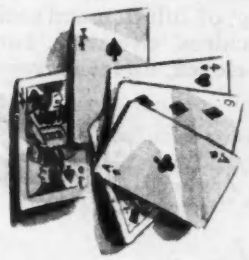
THE MOST *Versatile* FINISH OF ALL

METAL. Nitrocellulose lacquer offers *big* advantages to manufacturers using metal: *Unlimited* color range—high gloss or dull matt finish—*fastest-drying* finish known—easy and cheap to apply and repair.

LEATHER. Lacquered leather lasts longer—looks lovelier, because it is protected from perspiration, scratches. May be easily cleaned.

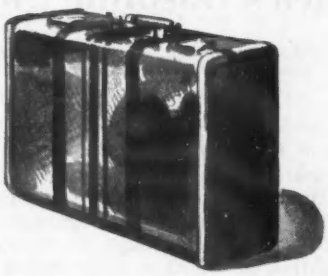
WOOD. Good for both expensive *and* economy types of furniture, nitrocellulose lacquer protects, lasts, looks well, resists dust and fingerprints, ideal for assembly line production.

RUBBER. Nitrocellulose lacquer is an extremely flexible finish—making it ideal for galoshes, many other rubber articles. Imparts gloss and preserves the rubber.



PAPER. Paper may be *rollercoated* with crystal-clear or colored nitrocellulose lacquer. Brightens and intensifies colors, resists scuffing, damage from handling, fats, acids and fingerprints. Waterproofs, is washable.

FABRICS. There's a growing market for light, airplane-type luggage—and nitrocellulose lacquers are the ideal finish—non-scaling, never sticky, good-looking.



CL-46

HERCULES

NITROCELLULOSE

Hercules makes no finished lacquers, but supplies the nitrocellulose from which lacquers are made. For helpful application information on your finishing problem, call your lacquer supplier. Cellulose Products Department, Hercules Powder Company, 14 Market Street, Wilmington, Delaware.

hi-g
Remote Valve Controls
that reduce weight

General Controls' **hi-g** Electro-magnetic valves control important aircraft functions, such as propeller feathering, wing flap, landing gear, anti-icing and temperature controls.

hi-g valves are fast-acting, compact, light in weight. **hi-g** indicates their positive ability to operate in any position, regardless of vibration, acceleration or change of motion.

Designed for continuous or intermittent duty, **hi-g** valves are available in more than a score of types for handling aromatic or domestic gasolines, vapors, air, steam, water, hydraulic and lubricating oils, and anti-icing fluids under pressures up to 3000 lbs. or more. They are supplied in a wide range of AN pipe sizes or tubing connections, and AN electrical connectors. Normally open, normally closed, single seated, pilot piston operated and 3 or 4-way selector valve types.

Write or wire today for complete engineering data and descriptive bulletin.

A LIGHTWEIGHT CHAMPION

General Controls' type AV-1, pictured above weighs only 8½ ounces. This valve is designed for cabin heating, oil dilution and anti-icing applications. Packless, two-wire, current failure, normally closed, direct current, magnetic valve.

VIBRATION RESISTANT hi-g valves can be engine-mounted. On trucks, tractors, locomotives, tanks, ships, graders and other moving equipment, they simplify plumbing—save materials, space, weight, time and money.

hi-g
GENERAL CONTROLS

Wartime Manufacturers of Electro-Magnetic and Temperature Controls for Aircraft

Peacetime Manufacturers of Automatic Pressure Temperature, and Flow Controls

801 ALLEN AVENUE, GLENDALE 1, CALIFORNIA

BOSTON • NEW YORK • PHILADELPHIA • DETROIT • CHICAGO
CLEVELAND • DALLAS • DENVER • SAN FRANCISCO • ATLANTA

Tractor Production

(Agricultural, Industrial and Military)

	1943		1942	
	Number	Value	Number	Value
Wheel Type—All kinds	105,248	$63,784,198	172,123	$102,557,627
With steel tires	66,272	37,946,049	74,679	43,217,016
With rubber tires	38,976	25,838,149	97,444	59,340,611
Wheel type except "All Purpose" By Belt Horsepower Groups—				
Under 25	6,208	$3,360,245	6,869	$3,342,986
25 to 29	1,451	1,198,363	1,284	1,096,813
30 to 35	4,269	3,426,311	4,684	3,276,488
36 to 49	4,291	5,028,511	7,427	7,201,383
50 and over	351	399,818	871	922,230
Total—Wheel type except "All Purpose"	16,570	$13,413,248	21,135	$15,839,902
Wheel type—"All Purpose" By Belt Horsepower Groups—				
Under 30	80,838	$45,340,893	131,965	$73,074,468
30-35	7,054	4,278,443	16,809	10,627,184
36 and over	786	751,614	2,214	3,016,073
Total—Wheel type—"All Purpose"	86,678	$50,370,950	150,988	$86,717,725
Tracklaying Type By Belt Horsepower Groups—				
Under 50	11,182	$25,907,776	13,072	$23,744,198
50 or over	18,271	109,535,353	16,506	80,378,941
Total—Tracklaying type	29,453	$135,443,129	29,578	$104,123,139
Garden Tractors, including motor tillers	8,788	$1,287,728	13,373	$1,675,590
Total—Tractors—All types	143,489	$200,515,055	215,074	$208,556,356
Attachments for tractors		$17,455,694		$22,941,091
Parts for tractors		$139,388,086		$105,611,189

Production of Internal Combustion Engines Under 100 hp.*

(Does not include automotive, airplane, marine and locomotive engines) 1943 and 1942

	No. of Mfg'r's.	1943 Production		1942 Production	
		Units	Value	Units	Value
Engines, internal combustion (stationary and portable, all-purpose, except automotive, airplane, marine and locomotive, under 100 horsepower	31	589,295	$78,448,845	485,168	$44,072,626
Air cooled engines	13	410,603	22,992,736	403,841	22,036,629
Water cooled engines:					
Under 5 horsepower	11	15,216	740,012	19,968	1,112,216
5 or more, but under 10 hp.	12	30,166	3,254,870	5,166	488,606
10 or more, but under 20 hp.	13	58,740	9,467,504	8,323	1,445,126
20 or more, but under 50 hp.	18	39,992	17,153,055	28,437	7,210,163
50 or more, but under 100 hp.	15	34,578	24,840,668	19,433	11,779,886
Total—Water Cooled Engined		178,692	$55,456,109	81,327	$22,035,997
Attachments	8		$8,053,179		$533,946
Parts	16		$26,078,694		$9,647,203
Total Value of Agricultural, Industrial, Military Engines with parts and attachments			$112,580,718		$54,253,775

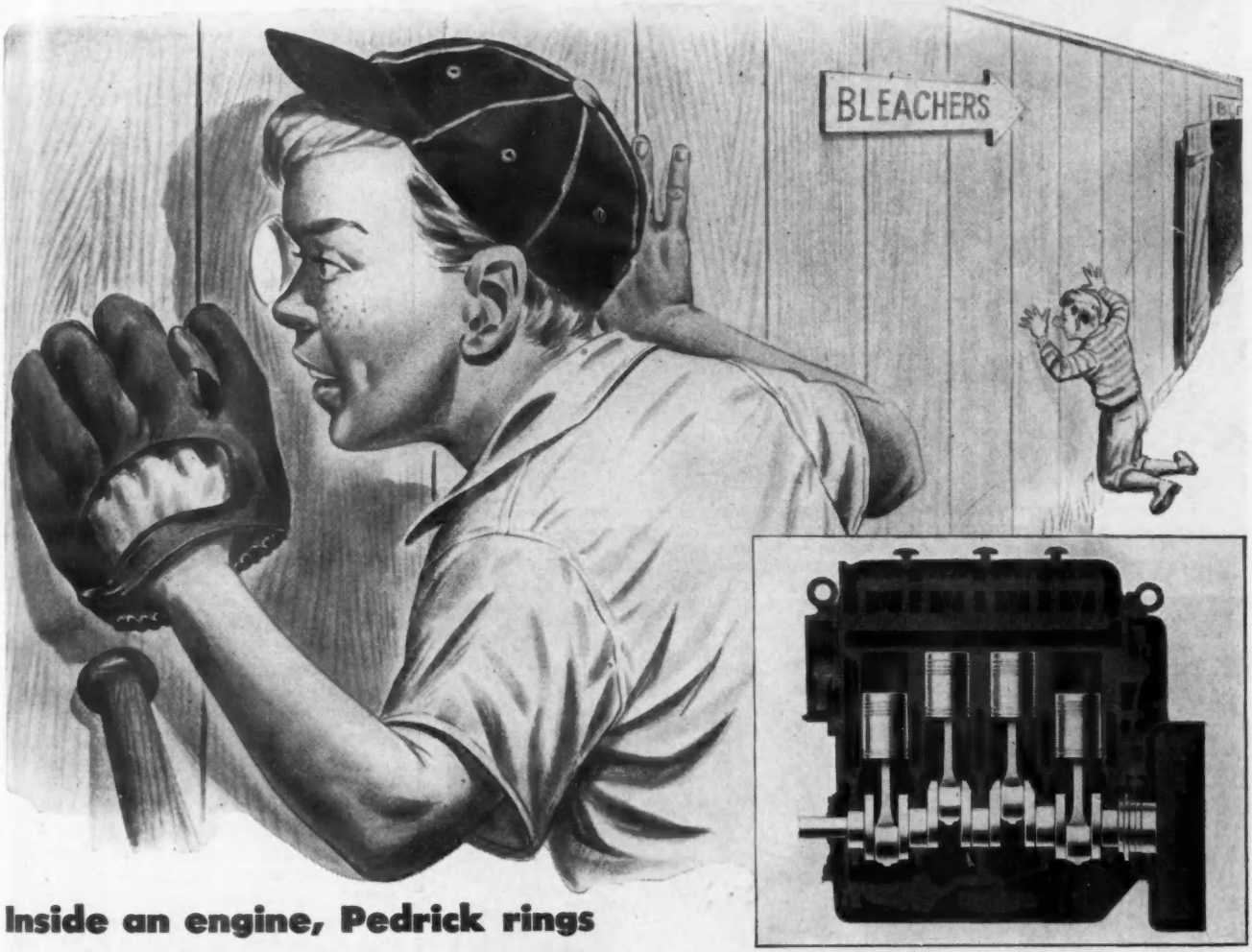
*—Bureau of Census.

America's Gasoline Supply

(*Continued from page* 27)

gasoline from shale. The extent of success or failure in the uncovering of oil reserves by the traditional methods of wildcatting and exploration in general will make itself quickly felt in the degree of enterprise and capital investment that will be attracted to hydrogenation as well as the setting up of commercial shale oil plants. Cost will answer the question of whether their status will be that of stand-by blue print safeguards against undersupply in the event of another war or whether they will have an important part in supplying the postwar market.

It's what goes on INSIDE *that counts*



Inside an engine, Pedrick rings "wear-in" faster and safer!

WHEN new piston rings do not "wear-in" or "seat" quickly, lasting damage may be done to the cylinder walls by scuffing or scratching.

A special coating on Pedrick *precisioneered* piston rings speeds up the "wearing-in" process and literally cushions the cylinder walls against any damage during this critical period. There is the further protection, too, of Pedrick's exclusive Heat-Shaping method which makes possible exactly correct shape, tension, and flatness. This also assures quicker, safer "seating."

Pedrick *precisioneering* is represented in the vastly improved performance of aircraft engines such as 1000 higher r.p.m., 3-mile higher ceiling, 400 more hours of flying between engine overhauls. It is represented also in the amazing dependability of the Diesel engines which power our countless landing craft. If you are concerned with any kind of engine, or compressor, or pump, or hydraulic equipment . . . wherever extreme pressures must be sealed or controlled . . . investigate what Pedrick *precisioneering* can do for you. Remember, it's what goes on *inside* that counts!

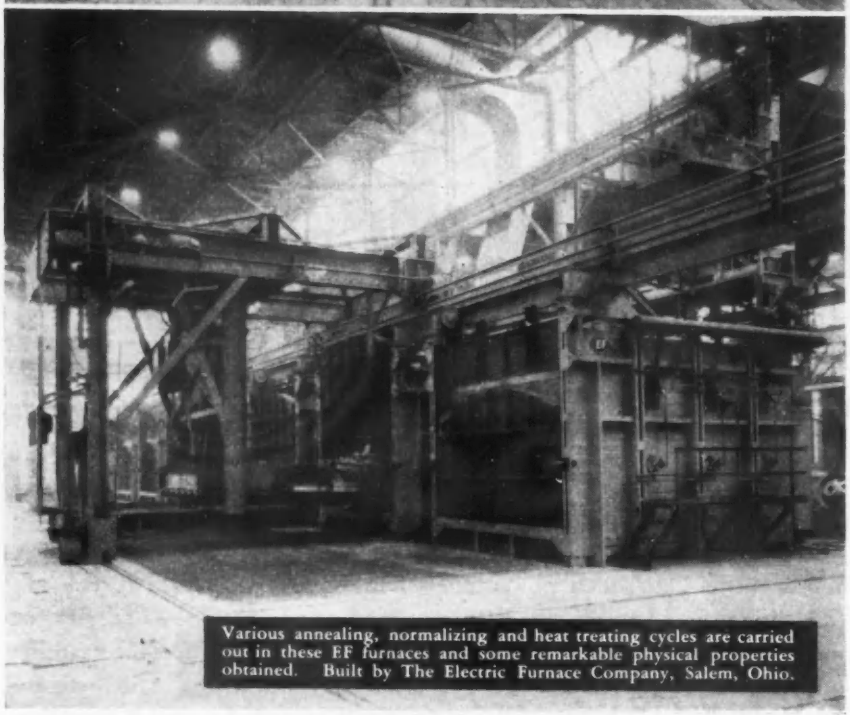
WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

Pedrick

precisioneered **PISTON RINGS**

WAR BONDS IMPROVE WITH AGE . . . HOLD ON TO THEM

An installation of EF fuel fired batch type furnaces with quenches and special gantry cranes for handling large castings. Designed and built by The Electric Furnace Company, Salem, Ohio.



Various annealing, normalizing and heat treating cycles are carried out in these EF furnaces and some remarkable physical properties obtained. Built by The Electric Furnace Company, Salem, Ohio.

FURNACES OIL, GAS or ELECTRIC

For Every Heating and Heat Treating Process

Aluminum Brazing	Carburizing	Nitriding
Annealing	Drawing	Normalizing
Billet Heating	Enameling	Soaking Pits
Bright Annealing	Forging	Scale-Free Hardening
Bright Hardening	Hardening	Quenching Machines
Copper Brazing	Malleablizing	Ceramic Kilns, etc.
Controlled Atmosphere	Silver Soldering	Process Heating

We Build the Furnace to Fit Your Job

THE ELECTRIC FURNACE CO.

SALEM, OHIO

ELECTRIC FURNACES FUEL FIRED

Truck Output Lags

(*Continued from page* 46)

frame weight (including spare parts) hit a new peak with an output of 102,418,000 pounds, 1,000,000 pounds above the previous record set in March. Heavy bombers made a particularly good showing, with all major combat types meeting or exceeding quotas.

At the Willow Run Ford Bomber Plant, the 5000th B-24 Liberator bomber rolled off the assembly line June 29, well ahead of schedule. Of this total, 3000 have been flown away and 2000 have been trucked in knockdown form to the Tulsa, Okla., and Fort Worth, Texas, plants of the Consolidated Vultee Aircraft Corp. for assembly. More than half the total production to date has been turned out since the first of this year. Working two shifts of nine-hours each, the 30,000 present employees are maintaining a consistent bomber-an-hour average schedule, with 450 planes a month not uncommon. Although originally projected for about 80,000 workers, the plant now is producing above its quota with 12,000 fewer employees than it had at its peak employment in 1943. Improvement in production techniques and assignment of certain assemblies to other Ford plants account for the higher production with fewer workers at Willow Run.

Another aircraft manufacturer, the Buick Division of General Motors Corp., passed a milestone during June, when it produced its 50,000th Pratt & Whitney aircraft engine. The company started production on these motors one month after Pearl Harbor and in the ensuing 30 months has turned out more than 60,000,000 horsepower at its Flint, Mich., and Melrose Park, Ill., plants. Buick now is retooling for production of two new Pratt & Whitney motors for use in the Liberator bomber and the four-engined Douglas C-54 transport plane. Both engines are twin-row Wasps, the R-1830-75 and the R-2000-9. They are of different dimensions and develop greater horsepower than current types. The company has announced that despite its current success in the aviation field, it does not expect to remain in aircraft production.

A large section of one large Hudson Motor Co. plant at Detroit has been converted to production of outer wing sections for the Lockheed P-38 twin engine fighter bomber. Several thousand workers will be employed on the new job, which is expected to get into high gear rapidly because of Hudson's previous two-year experience in building folding wings for Curtiss dive bombers.

Four-fifths of the machinery and equipment now being used at the Dodge Division of Chrysler Corp. for making outer shells for rocket projectiles formerly was used in automotive production. The part, a forging, is sent upon completion to the Chrysler Division, where other parts are made, and assembled for shipment.

The landing vessel program con-

QUICK-COUPLER... newest of Marman clamps . . . combines a snap-on latch with the full adjustment of a standard clamp . . . all in one simple unit. This instant-action clamp is ideally suited for handling removable equipment such as oxygen containers, fire extinguishers, removable duct sections, etc. It helps the men who keep the planes in operation to get things off and get them on again . . . FASTER.

CHARACTERISTICS OF ALL MARMAN CLAMPS

Circumferential Loading

Tension is uniform around any convex surface. No bulging, pinching or distortions.

Quickly Installed Quickly Removed

Marman Clamps may be opened and wrapped around any connection. May be installed and removed repeatedly without efficiency loss.

A Size and Shape For Every Job

Circular, oval, square, oblong and irregular shapes are all easily handled with Marman quick-couplers.

MARMAN clamps

MARMAN PRODUCTS CO. Inc.
940 WEST REDONDO BOULEVARD
INGLEWOOD, CALIFORNIA

tinues important, with May deliveries running 10 per cent ahead of schedule and with production totaling 198,000 tons, nearly 50 per cent above April output. Schedules are expected to taper off by October to about 132,000 tons, which however, is higher than any peak prior to May.

Donald M. Nelson WPB chairman, states in the report on May munitions production that despite production adjustments, the munitions program is due to increase some 13 per cent in the next six months. He cautions that both industry and labor must guard against over-optimism and misunderstanding of the significance of changes in the munition program which are dictated by military and strategic exigencies. He states that there are certain to be so-called "cutbacks" and production adjustments in the near future, but these are expected to be only relatively small increases or decreases in specialized segments of the munitions program as battle experience shows need for more of fewer of certain weapons.

The relatively few workers who are freed from one program by a decreased schedule are expected in a great majority of cases to be shifted to other jobs in plants which are behind schedule or are expanding production, he points out.

Babbitt Lined BEARINGS

● Designers of the postwar automobile may worry about the lines of their new car . . . or synthetic rubber versus natural . . . or the thousand and one new developments that have come as a result of the present conflict. There is, however, one worry that they can forget . . . and that's the type of bearings to use in the engine. Years of research and practical tests have definitely proven that babbitt lined bearings deliver the best all around performance for internal combustion engines.

The dual construction of this type of SLEEVE BEARING provides conformability to the shaft . . . resistance to pounding . . . smooth, quiet performance at high speed . . . exceptionally long bearing life, and excellent running-in properties.

Babbitt Lined Bearings are ideal for a wide variety of applications. They are "tailor made" in the sense that you have a wide range of alloys to select from in the babbitt, and a choice of backing material—either bronze in any of the various alloys, or steel. Why not permit a Johnson Engineer to study your bearing problems? He can easily advise you on the *correct* type of bearing for each application. There is one located near you.

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
625 S. MILL STREET NEW CASTLE, PA.

Third Quarter Steel Production

(*Continued from page* 46)

the economies in copper consumption that resulted from the activities of the brass and bronze ingot industry, which processed last year 500,000 short tons of copper-bearing salvaged material, producing approximately 1,000,000,000 pounds of alloy ingot metal, in the making of which less than 3 per cent of new copper was required.

Severance of our relations with Finland was preceded by issuance of a statement by Foreign Economic Administrator Leo T. Crowley, in which he pointed out Germany's dwindling supply of the ferro-alloys necessary for the production of shells, tanks, artillery and other munitions as well as the manufacture of war plant tools. Finland has been contributing more than half of the Nazi supply of cobalt and nickel and one-fourth of their supply of molybdenum. Shortages of manganese and chrome, for which nickel and molybdenum could be substituted to a certain extent in the production of alloy steel, aggravated the plight of the Germans. The Germans lost the vital source of two-thirds of their manganese supply when the Russians recaptured Nikopol.

New Process Improves Reclaimed Rubber

A new process that improves the reclaimed rubber needed for tires and other war products is announced by The Firestone Tire and Rubber Company.

The new reclaim is said to result in an increase in both tread wear and body performance of "victory" tires.

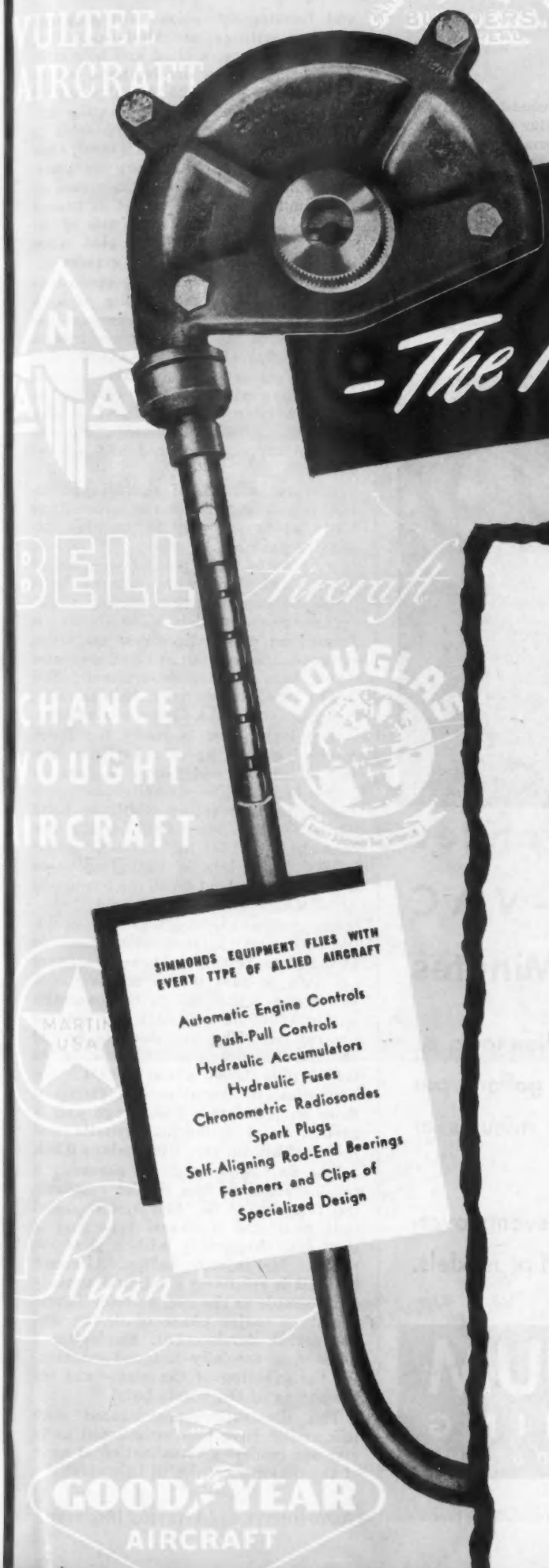
Paul D. Bowers of the company's Memphis plant developed the new process, which is called "flash" devulcanization, by which the scrap is exposed to steam at very high pressures.

The shortened devulcanization time preserves inherent qualities and consequently produces a reclaimed rubber with high tensile strength and resistance to abrasion.

Aircraft Accessories Corp. to Make Brake Equipment

By acquiring the Power Brake Division of the Besler Corporation recently, the Aircraft Accessories Corporation becomes manufacturers of what is said to be one of the most complete lines of brake equipment for commercial motor vehicles in the United States.

The Besler brake operations will be moved from Emeryville to Burbank, California, and incorporated with the Power Controls Division of Aircraft Accessories. This concern now is producing air brake valves for trucks, trailers and buses and a hydraulic power brake system for trucks and buses.



Simmonds Push-Pull Controls
—The Industry's Choice

SOME OF THE MANY USES:

Propeller Pitch and Governor • Throttle • Carburetor Air and Filter • Supercharger • Remote Valve Control • Mixture • De-Icer • Cargo Door

•

YEARS of leadership in the field, an outstanding record of performance, continued modernization of design . . . these are the reasons why Simmonds-Corsey Push-Pull Controls are the choice of leading aircraft manufacturers. With more than a decade of operating experience, these precision-built controls were the first to gain the Yellow Dot of acceptance in the U. S. Army Air Force Winterization Program, attesting to high performance under Arctic conditions.

More than 500,000 Simmonds controls have been installed on aircraft of the United Nations. A new design innovation is the Radian Unit (illustrated) to provide rotary action from basic push-pull operation. Because of their rugged precision-built qualities, these controls are fast finding new applications in the automotive and ordnance fields as well as in aviation.

Strategically located Simmonds branch offices make possible the utmost in customer service. Let us help you with your control problems. Your inquiries are invited. Write for free descriptive literature.

SIMMONDS
AEROCESSORIES INC.

30 Rockefeller Plaza, New York 20, N. Y.

Branch Offices:
Dayton • Washington • Hollywood • Montreal
Manufacturing Plants: New York • Vermont • California

Ex-Cell-O Production

(*Continued from page* 22)

precision-bored on an Ex-Cell-O boring machine. The large mounting flange is finish-turned on a lathe. The faces, bosses, timing mark, and flange cut-out are milled. Following the completion of machining, the housing is cadmium-plated all over to produce a corrosion-resistant base for the finish paint.

Like most of the parts that go to make an Ex-Cell-O fuel pump, the body has many fussy tolerances. For example, the bearing liner bore as produced on the precision-bored machine is held to 1.125 in. plus or minus 0.0005. The large seat forming the interior face for the liner is burnished, after plating, and is held smooth, flat, and square with the axis of bores. Axial alignment is held within 0.0005 in. total indicator reading.

One of the major elements of the pump assembly is the tappet body, which is produced as an electric furnace iron casting. The initial turning and forming operations are prepared in two settings on Mult-Au-Matics. The center bore, a blind end hole communicating with a smaller bore, is precision-bored to 1.0625 in. plus 0.0005 minus 0.0000. The six hydraulic distributing holes are precision-bored to 0.625 in. plus 0.0005 minus 0.0000; then lapped on Ex-Cell-O lapping machines, using diamond laps. A 13 deg face on the small end of the tappet is turned true on a lathe. The large OD of the body is ground 3.187 in. plus 0.000 minus 0.001 on a universal grinder.

Among the real exacting operations on this tappet is the drilling of a ½ in. hole through the periphery of the upper end of the body. This is held to 0.500 in. plus 0.0006 minus 0.0000. Another fussy detail is the milling of a slot in the periphery of the head of the tappet, holding the slot to 0.252 in. plus 0.004 minus 0.000. Following machining the tappet is burred all over by hand.

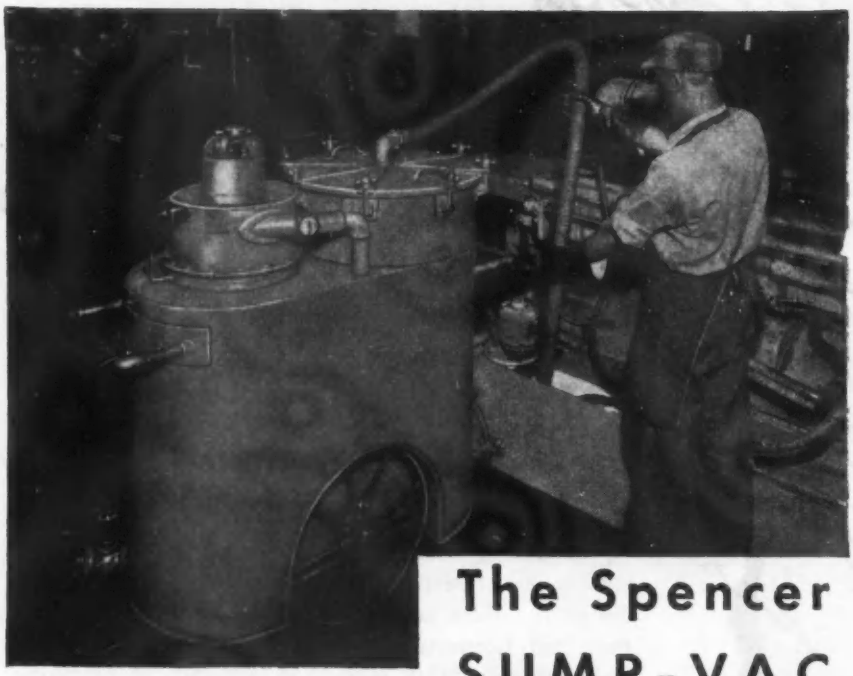
For an example of skillful production planning consider the pump drive shaft which probably is the most expensive part of the pump. Its design is such as to make possible the use of a standard blank which eventually is finish-machined to suit a variety of different pump models. The blank is formed on automatic screw machines, snagged, then carburized and annealed in the heat treating department. Following these operations, the blank is rough ground on a Centerless grinder.

The blank now is ready for finish machining to a specific part number. Initial turning and facing is done on turret lathes. The six-spline section is milled, holding spline width to 0.248 plus 0.0000 minus 0.0015, and spline base circle to 0.843 in. plus 0.000 minus 0.005. The piece is burred all over and returns to heat treat for hardening two diameters of the shaft end.

OD sections are rough ground on cylindrical grinders, later finish-ground in a separate setting. These diameters are held to plus 0.0000 minus 0.0003 in.; and are specified to be concentric within 0.0005 in. total indicator reading for runout. The long bore is ground on an internal grinder, holding to 0.4375 plus 0.0005 minus 0.0000. The formation of shoulders and radius is done on grinders. The flange end is ground on a cylindrical grinder and held to 2.249 in. plus 0.000 minus 0.001.

The Ex-Cell-O nozzle tip assembly is considered to be one of the outstanding features of the fuel system. One unit is of the universal type and is used interchangeably with a wide variety of fuel injector bodies. Although the unit is relatively small and appears quite simple to the eye, actually it represents a major phase of design and production development, employing a number of specially-designed machines for the grinding of the pintle and for the boring of the nozzle body.

The illustrations reproduced with this article have been so selected as to give our readers a visualization of some of the major activities in this plant.



The Spencer
SUMP-VAC
Cleans Sumps in 2 to 10 Minutes

A portable vacuum producer with a 125 gallon tank, on wheels, picks up liquid at the rate of 40 gallons per minute. Machine emptied by gravity in 2 minutes or elevates liquid by pressure up to 6 feet.

Filter basket collects chips, float valve prevents overfilling. No priming necessary. ¾ and 1½ H.p. models. Ask for the bulletin.

SPENCER HARTFORD VACUUM CLEANING
THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

16

"I want A FLEXIBLE GASKET TO WITHSTAND 2000° F." said the airplane part maker

"I want A FEEDWATER CLEANER THAT CORROSION WON'T CRIPPLE" said the railway mechanical engineer

"I want A FINE TUBE GRID THAT WON'T SAG" said the electronic tube maker

"I want A LASTING WICK FOR AIRPLANE HEATERS" said the cabin heater maker

All found their answer in

KNIT METAL MESH

Knit metal mesh has provided the answer to a lot of tough problems. Perhaps it's the answer to one of *your* problems, too.

The special *linked loop* design assures flexibility, high resistance to breakage, and bias strength.

The fabric holds together even when made of very fine wire (.0045" diameter) and with as few as 4 or 5 openings to the inch. It can be compressed lightly for air, liquid or gas filters . . . tightly for gaskets.

In applications requiring extra strength, toughness, resistance to high temperatures, corrosion resistance, and other specialized properties, INCO Nickel Alloys are used.

Thus, Inconel knit mesh is used for airplane exhaust manifold gaskets that must retain flexible strength at 1500° F., and for capillary wicks in airplane cabin heating units. Pure Nickel is used in a design that prevents sagging of fine mesh electronic tube grids.

Rustless, corrosion-resistant knit Monel pads are used to filter grit and scale from locomotive feedwater before it is pumped back into the boiler. The Monel mesh made from .006" wire, permits free flow of the water as there is 96% free space . . . 15,000 square inches of filtering area in a 14" x 20" pad. The pads are readily cleaned every four or five weeks in Oakite and Soda Ash Solution.

For further information, write direct to Metal Textile Corporation, Orange, N. J., makers of knit metal mesh, or to: The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

"I want A BETTER AIR FILTER MEDIUM" said the filter manufacturer

"I want A FLEXIBLE STRAP THAT WON'T JIGGLE LOOSE" said the magneto maker

INCO NICKEL ALLOYS

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL • *Sheet...Strip...Rod...Tubing...Wire...Castings*

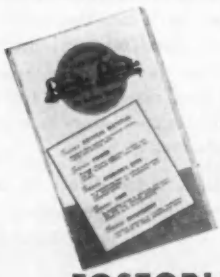
THE RIGHT LIGHT on Each CRITICAL SEEING TASK

Eyes are production tools, efficient only to the degree that lighting fits the "seeing" needs. Good lighting on one work operation is poor lighting on another more critical task. Lighting which is not engineered to each particular kind of operation, retards the worker's "seeing" ability and reduces his work capacity.

Balanced lighting proportions illumination to the "seeing" needs for each work operation. From rough work seeing to fine work seeing, each worker has the right light for his task — provided with the proper "seeing" conditions for maximum production speed and accuracy.

For a fundamental survey of light for "seeing" in your plant, call Fostoria Industrial Service. A study and recommendation by these qualified specialists will offer profitable solution to your lighting problem. Their counsel is available without obligation.

REQUEST THIS *free* BOOKLET TODAY!
Explains the efficient and economical results of "Balanced Lighting" and how to obtain it. Ask for BL-3-EC-AI



BALANCED LIGHTING fostoria
GENERALITES for Overall Lighting • LOCALITES for Light ON the Job
Trade Mark Reg. U. S. Pat. Off.

FOSTORIA INDUSTRIAL SERVICE
Factory and General Offices • Fostoria, Ohio
Independently Affiliated Manufacturers
Southern Industries, Inc., Atlanta
Amalgamated Electric Corp., Ltd., Toronto, Canada

NEMA

Cost and Budgetary Controls

(*Continued from page* 42)

weekly report, showing all departments, and for each department the cost per ship in hours over a series of weeks, with a total for all departments.

It is interesting to note a fundamental point of difference between the cost center report and the hours per ship report. Referring back to the percentage of realization as shown by the cost center report, attention is called to the fact that this figure is affected by the condition of standards and does not reflect any changes in standards. It should be noted that if standards are adjusted as they should be when a cost improvement is made, the percentage of realization will not reflect the improvement, whereas the cost per ship figure will.

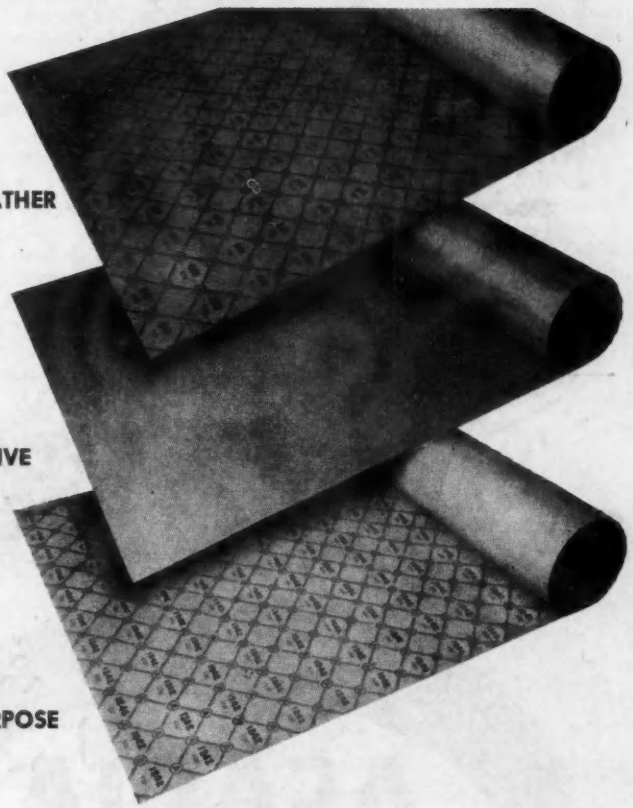
To make this point clear we refer to Chart 4. In this case we assume (A) that the production in equivalent ships is 160, the standard hours per ship is 7.50, and the total standard hours of production is 12,000 and total actual hours 16,000. We assume that in case (B) the actual time is reduced 20 per cent by a cost improvement and standards are also reduced 20 per cent. The figures of the cost center report would show under these two conditions, (a) standard hours of production 12,000, actual hours 16,000, percentage of realization 75 per cent; (b) standard hours of production 9600, actual hours 12,800, percentage of realization 75 per cent, thus showing no apparent improvement. However, looking at the figures of the hours per ship report we would find a condition as follows: In the first case where the standard hours per ship were 7½, the equivalent ships produced (standard hours of production divided by standard hours per ship) would be 160, and the actual hours per ship would be 100. In the second case the standard hours per ship would be 6 instead of 7½ (reduced 20 per cent by reduction of standards), the equivalent ships produced (calculated as 9600 standard hours of production divided by 6 standard hours per ship) would be 160, and the actual hours per ship (12,800 actual hours divided by 160 equivalent ships produced) would be 80; showing the reduction from 100 actual hours per ship to 80 actual hours per ship correctly, and fully recording the 20 per cent reduction in cost.

Equivalent Ships

Some explanation may be in order regarding the figure of equivalent ships reduced. The requirement for this figure derives from the fact that if there is a great variety of parts going through a department such as the Machine Shop where several hundred parts for the same model are processed, there is no other way in which we can arrive at a figure that will show the

3 ANSWERS TO MANY SEALING PROBLEMS

ARMSTRONG'S FIBER SHEET PACKINGS



No. 841
FIBRATED LEATHER

No. 143
NONCORROSIVE

No. 1242
GENERAL-PURPOSE

YOU'LL find the answer to any sealing problem requiring a fiber sheet among these three Armstrong's Packing Materials:

1. Armstrong's No. 841 Fibrated Leather is an especially resilient gasket material, recommended for both ordinary and heavy-duty jobs. It is excellent for sealing oil, gasoline, or water at temperatures up to 300° F. Made with live, springy leather fibers, No. 841 is compressible and tough. It is stable under varying conditions.

2. Armstrong's No. 143 Fiber Sheet Packing is a thin, dense, noncorrosive material, developed for use with aluminum alloys.

3. No. 1242 is a general-purpose material that provides a good seal at low cost.

Armstrong's Fiber Sheet Packing Materials are available in rolls and sheets, or in gaskets die-cut to your specifications. For samples of Armstrong's Sheet Packings—or of any of the other products in Armstrong's automotive and aviation specialties line—write Armstrong Cork Company, Industrial Division, 1507 Arch Street, Lancaster, Pa.

Armstrong's No. 841 and No. 1242 Fiber Sheet Packings meet the following specifications: Federal E-HH-P-96a; U. S. Navy 33 P 22b; Underwriters' Laboratories, Inc. (for sealing hazardous liquids). Armstrong's No. 143 Sheet Packing meets Army-Navy Aeronautical Specification AN-HH-G-171.

ARMSTRONG CORK COMPANY

MATERIALS AND SPECIALTIES FOR AIRCRAFT AND AUTOMOTIVE UNITS

- **Gaskets, packings, seals,** piston cups, bushings, and valve seats—for gauges, fuel lines, meters, hydraulic systems, and other equipment
- **Composition roll goods,** with or without fabric back, plain or adhesive-coated—used as glazing strip, binding tape, cushion pads, anti-skid flooring, and gaskets
- **Tank strap cushions**
- **Sealing materials** for specialized aircraft equipment handling aromatic fuel
- **Felts** for vibration-damping and soundproofing
- **Wingwalk materials**
- **Resilient floorings**
- **Carburetor floats** and other fabricated natural or composition cork specialties

number of ships produced by the Machine Shop, because the quantities of each of the various parts produced are never exactly balanced and are not produced in correctly balanced sets for a certain number of ships during the period involved. By counting the number of each part produced and converting this into standard hours of production and totalling the standard hours of production on all parts for the period involved, we have a figure which may then be divided by the total standard hours required to produce one ship and thus arrive at the number of equivalent ships produced.

Beside its use in control reports, this figure is reported in a tabulation showing the production in equivalent ships, by all departments, for a series of weeks. This provides for a comparison of departments with each other and against schedule.

In this connection it is important to note that we are measuring completion in the same terms as prediction; production being measured in terms of standard hours rather than in terms of actual hours. There was a time when attempts to compare actual production with scheduled production were limited to measuring scheduled production in estimated hours and comparing with this the production as measured by actual time used. In view of the fact that it was entirely possible, and frequently the case, that the shop might be taking two or even three hours actual time to produce one hour of work, as measured by standard or estimated hours, it was obviously an error to rely on such figures. This condition existed because there was no way to record the production of each part and convert it into standard hours. When we measure production in standard hours and equivalent ships (the same terms as prediction), the comparison is thoroughly reliable.

It should be noted that the production of spares is measured right along with regular production and the figure of equivalent ships produced therefore includes spares produced. When the total actual time (including time spent on spares) is then divided by this number of equivalent ships produced, the figure of actual hours per ship produced therefore excludes the time spent on spares although this is included in the calculation.

Attention is called to the fact that in all of these figures it is assumed that the inventory of work in process remains unchanged from week to week. It is well known of course that this is not actually the case. The figure of actual hours per ship calculated in this way, therefore, fluctuates from week to week because of this change of work in process inventory. For this reason it must be borne in mind that in using this figure the average of several weeks should be used rather than the figure for any individual week. A meticulously accurate figure for each week could of course be obtained by the expenditure of a great deal of time and effort to secure a recorded or calculated figure correctly measuring the amount of work in process each week. It is felt, however, that the advantage of such accuracy would be greatly outweighed by the expense involved in securing this figure.

Indirect Expense Standards

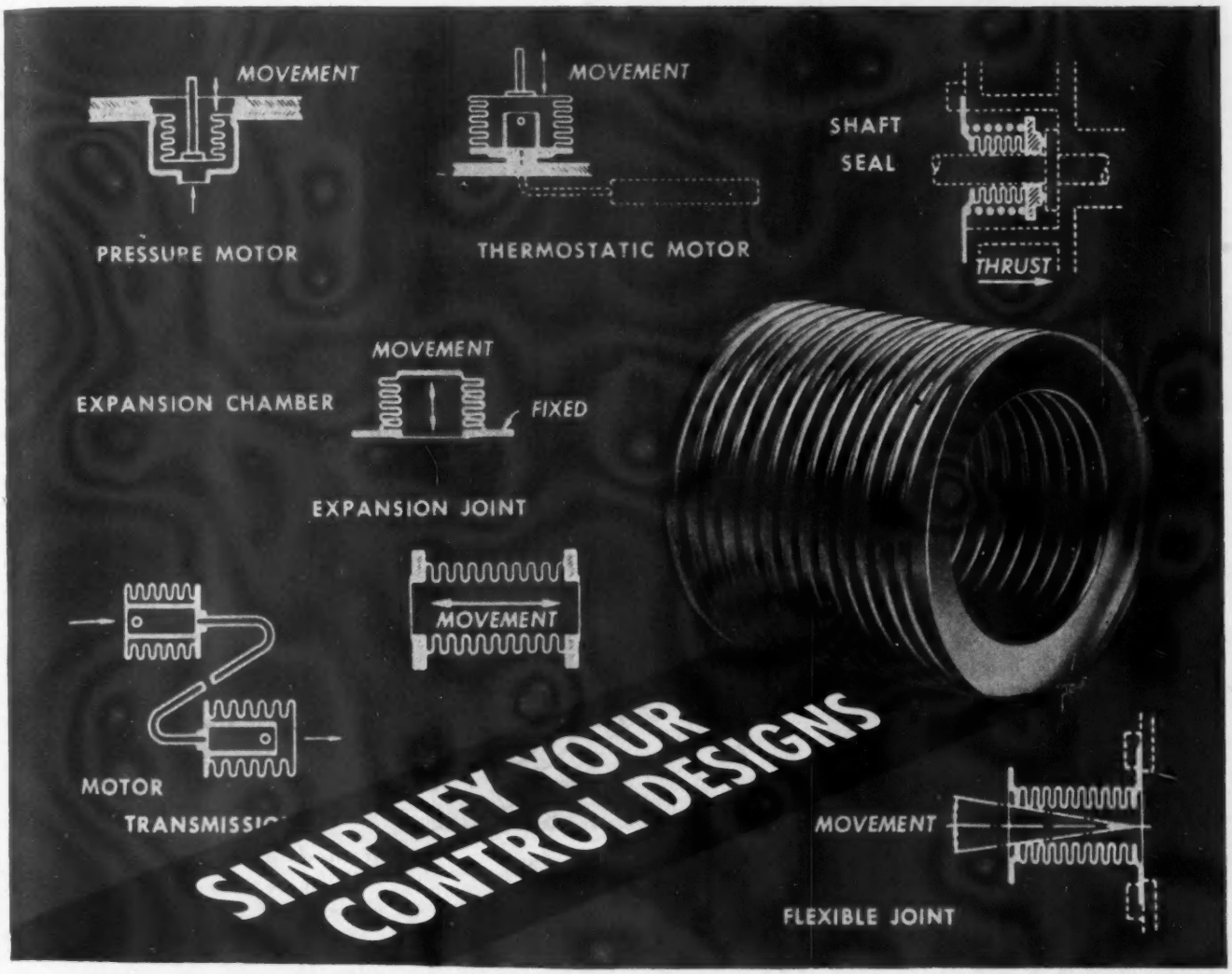
The setting of standards for items of indirect expense requires a very different technique from that used in setting direct labor standards. It is necessary at the outset to appreciate the variable nature of these items as is recognized in the principle of the "variable budget." The need for this treatment may best be illustrated by reference to a common situation with which we are all familiar. In the case of a productive labor operation which involves both operating time and set up, it would be a mistake to set a standard of a certain number of hours for each time the job is run, for the size of the lot run may vary from time to time. It would be equally wrong to set a standard based exclusively on the number of pieces run, pro-rating the set up time on the basis of the number of pieces in a certain size of lot, because set up

GIVING FORM
TO CHEMISTRY'S COMPOUNDS—
ACADIA
Synthetic Products

• While chemistry compounds the ingredients which make synthetic rubber, Acadia Synthetic Products processes that rubber to give it form; molding, extruding or cutting it to close tolerances to fill your requirements.

To this task Acadia brings wide experience in synthetics, manufacturing ability, and service offered through the cooperation of their engineers in helping determine the synthetic best suited to your needs.
Write us today.

ACADIA Synthetic PRODUCTS
Processors of Synthetic Rubber and Plastics • Sheets Extrusions • Molded Parts
DIVISION WESTERN FELT WORKS
LARGEST INDEPENDENT MANUFACTURERS AND CUTTERS OF WOOL FELT
4035-4117 Ogden Ave., Chicago 23, Ill. Branch Offices in All Principal Cities

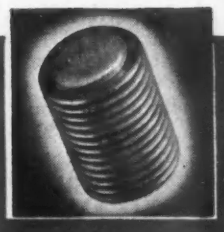


WHEREVER there are temperatures or pressures to be controlled—expansion to be absorbed—motion transmitted or rotating shafts to be sealed—correctly engineered bellows offer a *simple* solution to seemingly complicated problems of design.

They can be made strong enough to withstand high pressures—with multi-ply walls if necessary—or delicate enough for thermostats designed to convert minute temperature changes into calibrated mechanical movement. There is no end to the design possibilities of Bridgeport Bellows.

* * *

Whatever your problems involving bellows, we invite you to lay them before us. A complete service is at your disposal—engineering, experimentation, testing and manufacturing facilities geared to meet today's production requirements. Write for our new catalog. Ask for OB-100.



Bellows Assemblies . . . Bellows . . . Bellows Devices

BRIDGEPORT THERMOSTAT COMPANY, INCORPORATED—BRIDGEPORT 1, CONN.

CASE HISTORY
This single Kold-Hold Sub-Zero machine handles the output of expansion fit cylinder liners for four furnaces. Double the capacity of former equipment.

Productioneered

BY KOLD-HOLD

Typical of Kold-Hold "Productioneering for Industry" is this experience of a large automotive and aviation manufacturer (name on request).

Faced with a tough, costly bottleneck, Kold-Hold "productioneered" a cold processing unit to fit the manufacturer's problem . . . the results were — production per hour doubled, serious bottleneck broken, closer fits attained and distortion eliminated. This is an outstanding Kold-Hold "productioneering" performance.

Maybe you have a similar "toughie." A look through our catalog, S-Z 431, may show you a machine that will fit your cold temperature application. Tell us about it and we'll help you "productioneer" your production problem. Kold-Hold machines over a range of from —100° to +200° on capacities from 2 to 400 cubic feet. If pressure and humidity control are required, we have them, too.

KOLD-HOLD

**Engineered for Production*

45 NORTH GRAND AVENUE ● LANSING 4, MICHIGAN

time is constant regardless of the lot size. Standards for such work are therefore set up on the basis of two figures: One covering the variable item of operating time, which is set on the basis of a fixed standard per hundred or per thousand pieces; the other covering the constant element represented by the set up time. This provides what is in effect a variable budget, for with each lot the total standard time per thousand pieces including both set up and operating time varies with the size of the lot.

The Variable Budget

In setting standards to cover expense items this same principle is applied, for analysis will develop the fact that some portions of expense are constant per month or per week regardless of the volume of the work going through the department, just as set up time is constant regardless of lot size, and some expense items are variable; directly proportioned to the volume of work produced during the week or month, just as operating time is directly proportioned to the number of pieces in a lot. Some items of expense fall in a category between these two types and may be accurately covered by treating a part of the expense involved as constant and the rest of the expense as variable, producing in total the proper balance between the two.

Methods of Analysis

There are three basic methods of analysis which may be followed in setting up variable budgets. The first is analysis by elements in which each element involved in the item of expense for which a budget is being set up is analyzed to see whether it is a constant item (one for which a flat monthly figure would be appropriate) or a variable item (one which varies in direct proportion to changes in the base unit of measurement of production). By totaling these variable and constant items separately and dividing the total of the variable items by the volume of production at the point to which the analysis applies, we may calculate the formula for this budget item. Such a budget would be expressed in some such manner as this: "Four Hundred Fifty Dollars per month constant plus Fifteen Dollars per thousand standard hours of production."

The second method is by the study of past history. By plotting on a chart (see Chart 5) a series of points each representing one month's figures of actual expenditure compared to volume of production, placing each point at the intersection of the line representing dollars expended and the line representing volume for that month, we will have a series of points which may very definitely indicate the proper slope and location of the formula for past history. In plotting such a line, it is advisable to calculate the average point for all months charted and plot this on the chart also. It is obvious that

When writing to advertisers please mention AUTOMOTIVE *and* AVIATION INDUSTRIES

First Helper examines Micromax Roof-Temperature Controller of an open-hearth furnace.

How the Fuel Valve is Throttled

Rayotube can be used with Strip-Chart Controller, shown here, or Round-Chart or Non-Recording Controller (as required). Part of control wiring is in Controller; rest is in MEC Valve Drive; Vacuum Tube Relay links the two actions, with electric speed and sensitivity. The effect seems as responsive as though the stable, sensitive galvanometer were tied directly to the valve, for each tiny change of temperature causes *proportional* throttling.

FURNACE OUTPUT JUMPS WITH HELP OF MICROMAX

In looking for a way to increase output, production executives of a steel mill saw a possibility in the open-hearth furnace shop. The furnaces were producing very satisfactorily; but they would certainly do even better if only some way could be found to run their bath temperatures right up to maximum, at desired times, without danger of over-shooting and damaging the roof refractory.

However, temperature was manually controlled, and the First and Second Helpers were compelled to hold it well below maximum because otherwise they have to watch it more continually than they could afford. Obviously, what was needed was automatic control, which would concentrate on temperature alone. Here's how the need is met:

The principle is simply to let the roof itself limit the temperature, since it's the roof which is damaged by overheating. A Rayotube (L & N radiation detector) is mounted in such a way as to receive radiated heat from the part of the roof which will become hottest. The First Helper sets the Micromax Pyrometer's control point at the highest safe temperature of that part of the roof, and control is based on radiation from it.

To make sure the fuel isn't chopped off drastically when a small reduction might suffice (or, of course, vice-versa) the Micromax Recording Controller *throttles* the fuel up and down. The fuel valve moves suddenly only if sudden action is indicated; usually it "edges" up and down — down and up again — holding temperature at the highest safe level for greatest production.

The experience which enabled us to specify this control is available for any other industrial temperature problem. And the variety of Micromax equipments assures you of a pyrometer in which accuracy, sensitivity, speed, type of control action and other factors are combined to create a control of utmost dependability.

Jrl Ad N-33B-643(1)

depends on me!
A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA.
LEEDS & NORTHRUP
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

the line representing the formula, regardless of its slope, must pass through this point. It is usually helpful to average together the points at the high end of such a line and plot this average and do the same for the points at the low end of the line. This will further aid in establishing the slope of the line. The formula for this line is easily obtained by reading the point at which the foot of the line strikes zero volume and establishing this as the "constant" figure. Deducting this from the total at any point will leave the "variable" portion as a remainder, and dividing this by the figure of volume at that point will provide the variable figure of so many dollars per thousand standard hours of production or whatever the measure of volume might be.

In the third method of analysis each item is studied in detail on the basis of the amount required for that item at varying percentages of capacity. Referring to Chart 6, let us assume that figures are set up for 20, 40, 60, 80, and 100 per cent of capacity, respectively. It is frequently convenient to relate this to the number of shifts, varying from one shift at 20 per cent to three shifts at 100 per cent of capacity as shown. Each item is analyzed separately and the totals are plotted on a chart in much the same manner as was done in the case of analysis by past history. The formula for each item can then be readily determined.

In setting up standards for the control of indirect expense at Vultee Field, all of these methods were used. In setting up and maintaining the formulas, it is important that a comparison be made between all departments on each item separately. For instance, in setting up a budget to cover operating supplies a direct comparison is made of the formula for operating supplies in all departments, comparing each department with the others. The actual setting of the formula to be used in calculating standards involves an extensive study to determine what constitutes good performance on the function in question. When this is determined it may be applied by reducing both elements of the formula (determined as already described) by the percentage necessary to bring figures in line with those determined as representing good performance. After the budgets have been set, charts are maintained, similar to the one shown under budgets analysis by past history, for use in considering possible adjustment to the budget formulas at a later date, each month's figures being plotted on this chart.

Chart 7 shows the formal statement of the standards covering all of the elements entering into the Departmental Operating Report of a productive department. Obviously, in the case of an indirect department the items are considerably different and it is necessary to use a much greater variety of bases for the variable portion of the standards.

Supervision Incentive Plan

At Vultee Field these budgets and the system of departmental operating reports were installed and maintained for several months before the supervision incentives were installed. In setting up the incentive plan, the objective was to include in the plan only those items which were considered of sufficient importance to warrant such emphasis. The items included are shown on Chart 8, which shows a typical calculation for one department. The figures of the Departmental Operating Report were used in two ways: First to provide an incentive for improvement within the department itself, and second, to stress the importance of cooperation between all departments. It was, therefore, provided that one part of the incentive pay should be based on average plant performance and another on departmental performance, as measured by the Departmental Operating Report in both cases. It was determined that the incentive payment should be largely based on the improvement in each month's performance as compared with the previous month rather than by comparison to any fixed base. Recognition was given to the fact that maintaining a performance approximately as

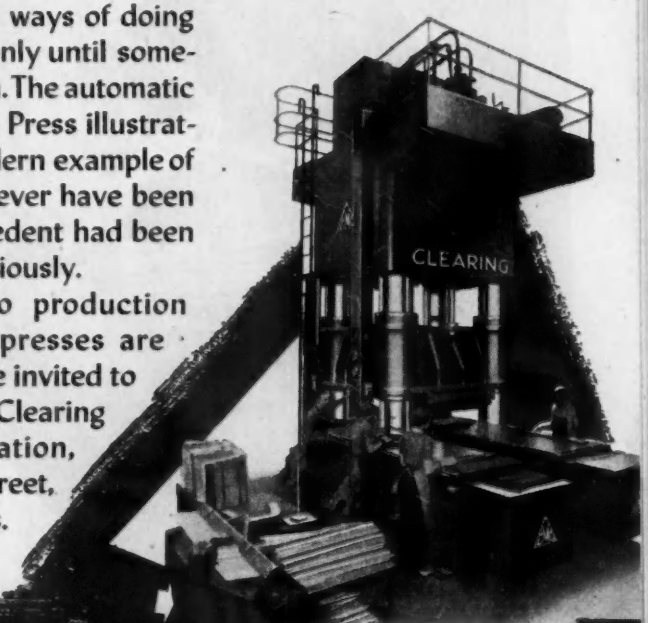
You'll never buy one of these
OPTICAL TESTING GAGE
For inspecting Porro Prisms and Objectives
but . . .
you might want the facilities that made it, as part of an Army Ordnance contract, to make things for you. Working entirely from blueprints we tooled up for its 104 component parts, made the gages that checked them, and delivered the first two completed instruments, in less than a month!
GO PRECISION AUTHENTICATORS NO-GO
ELECTRIX Corporation
Peacetime engineers of soft-rubber connectors for electrically-operated equipment, sold exclusively through U. S. RUBBER CO.
144 MIDDLE STREET, PAWTUCKET, R. I.

THE CIRCLE HAS A COUSIN

Despite "conclusive proof" by Plato himself that a true circle is the only curved figure of mathematical uniformity, today we know that there are several others. We have to thank Appollonius of Prega, circa 230 B. C., for recognizing the equal uniformity of such conic sections as the ellipse, and demonstrating his findings in the face of contrary opinion by accepted authority.

Appollonius was evidently our kind of man. It has been Clearing's experience that accepted facts are "conclusive"—and ways of doing things are final—only until somebody changes them. The automatic 3000 ton Clearing Press illustrated here is one modern example of a job that would never have been completed if precedent had been considered too seriously.

For solution to production problems where presses are concerned, you are invited to call on Clearing. Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois.



CLEARING

CMC CLEARING

good as that of the previous month was also worthy of reward.

Therefore, the percentages, figured both on basis of department and plant average performance, provide for the payment of a certain bonus percentage for maintaining the previous month's figure within a stated percentage and extra points of bonus for each percentage by which the previous month's performance is improved. The percentage paid for maintaining is figured as 10 per cent of the percentage of realization achieved. This feature therefore provides to take into consideration the actual percentage of realization attained, independent of improvement. To these are added percentages based upon the housekeeping rating of the department and its safety record. Other factors may be added, of course, whenever or wherever the Management feels this to be warranted by their importance.

The addition of this incentive had a very marked effect on the already worthwhile efforts of supervision to make a good showing on the Departmental Operating Report, and it is felt that the incentive has played an important part in the steady improvement of performance in the plant.

Additional Uses

Though time will not permit a detailed explanation, I feel it very important to call attention to the various other uses to which standards are put at Vultee Field. They are used as the basis of the Current Unit Cost Report shown in Chart 9. In this case the total cost of direct labor on each project in each department for the week involved is divided by the number of equivalent ships produced as calculated from the standards. The resultant cost per ship for each department is totalled and the other elements of cost are added to arrive at a total cost. A cost calculated in this way has the advantage of being absolutely current, as distinct from cost calculated on a release basis, where fabrication on some of the parts of the latest release closed may actually have been performed many months prior.

Standards are also used for parts costing. In this case the total standard hours, in each cost center, for the part or assembly involved is multiplied by the hours per standard hour (or divided by the Percentage of Realization) for that cost center for the period to be covered by the cost calculation.

The labor standards and the related charts of cost per ship form an essential part of the projection of future labor loads by months as required for the A.M.P.R., and for the setting up of projected profit and loss statements and projected burden rates. The preparation of such projected labor load figures is thoroughly covered in an article entitled "Projecting Labor Loads in Aircraft Production," of which reprints are available.

Standards are used for the calculation of machine and plant capacity and machine requirements, which are issued as a report showing the percentage of capacity of each machine in the plant that is required by existing schedules, and the number of machines of each type which are indicated as being surplus or short by this calculation.

Standards are used in scheduling to provide a balanced load for each machine or group of machines each week and for machine loading to provide a constant flow of materials to machines and work stations.

Any adequate discussion of the use of standards would of necessity include the technique used in each of these additional applications, but this would not properly be included under the heading of Cost and Budgetary Controls.

Distribution of Filmonize Tapes

National distribution of Filmonize, a complete line of pressure-sealing tapes, has just been announced by the International Plastic Corporation of Morristown, New Jersey. Now available through wholesalers, paper and mill supply jobbers, each of these Self-Sealing tapes has been developed with special properties for specific industrial applications and military uses.

ARTER
EXACT PARALLELISM
Pre-requisite on this exacting railroad piston ring grinding job by ARTER. There are many reasons why shopmen are enthusiastic about ARTER ROTARY SURFACE GRINDERS. Versatility, accuracy, simplification of operation are among them. For more than a quarter of a century, ARTERS have advanced progressively. Three models now available—"A", "B" and "C" with chuck diametrical capacities from 8" to 40".
ARTER GRINDING MACHINE COMPANY
WORCESTER, MASSACHUSETTS • U. S. A.

Around the Globe

Snap-on Tools – THE CHOICE OF BETTER MECHANICS

Snap-on Tools
THE CHOICE OF BETTER MECHANICS

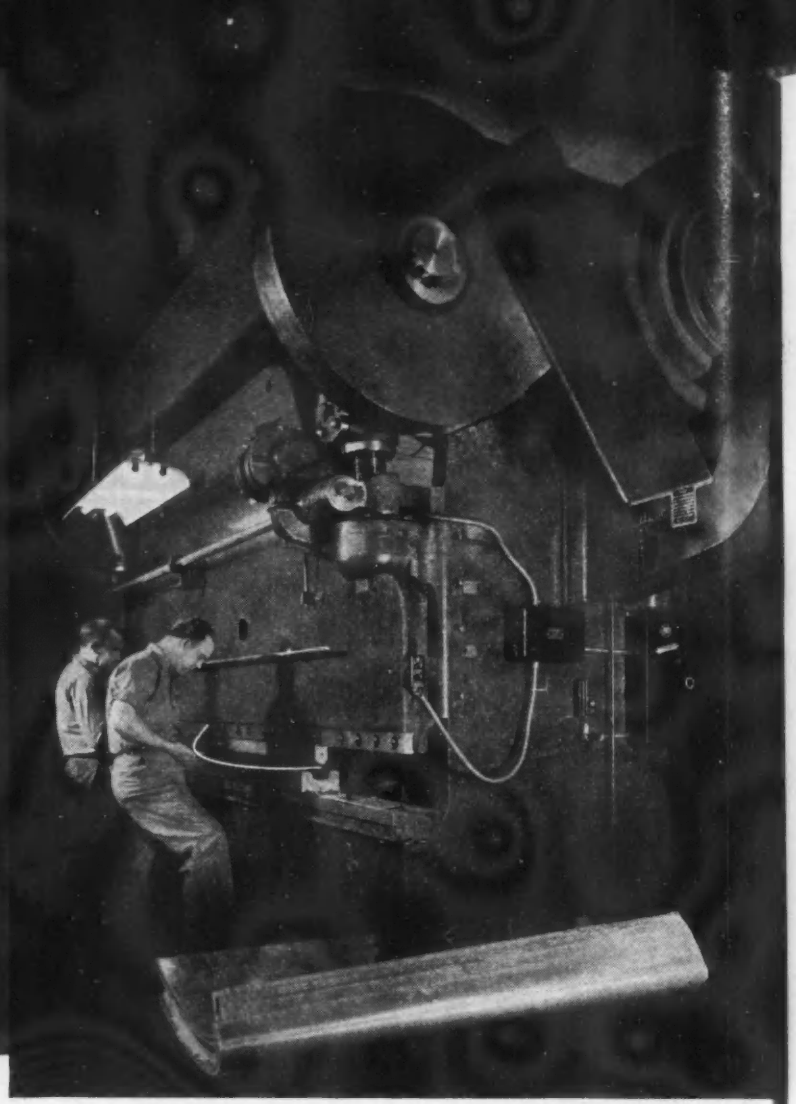
WHEREVER America's armed forces fight, Snap-on tools are with them . . . as indispensable in mechanized war as guns and ammunition. In the hands of battalions of resourceful mechanics, Snap-ons are on the job . . . helping maintain in top fighting efficiency the vast fleets of planes, tanks and ships which they played an equally important part in building. On fighing fronts as on the production front, Snap-ons stand out as *the choice of better mechanics*.

SNAP-ON TOOLS CORPORATION, 8054-G 28th Avenue, Kenosha, Wis.

R-301

the Aluminum Alloy that is

STRONG, CORROSION-RESISTANT, WORKABLE



The superior workability of R-301 offers a major advantage in forming curved or flanged parts.

PLANE DESIGNERS wanted a higher strength aluminum alloy for increased performance. Aircraft shopmen wanted an aluminum alloy of good workability in order to reduce production time. Users of aircraft wanted an aluminum alloy with good corrosion resistance, to withstand *any* atmosphere and climate.

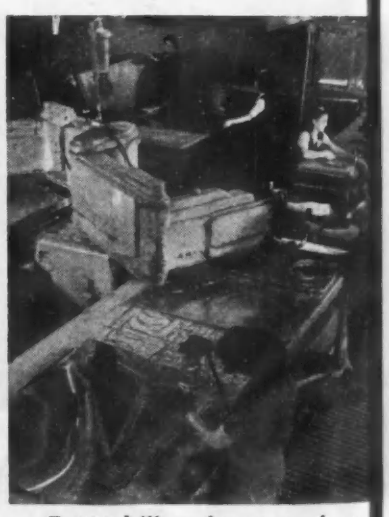
Reynolds' Metallurgists, reading these needs, created R-301.

R-301 is a high-strength aluminum alloy core, integrally bonded with a corrosion-resistant, medium-strength aluminum alloy cladding. The core and cladding alloys respond to the same heat treatment—resulting in a final product possessing high strength.

R-301 in the solution heat-treated temper is stable and more workable than any other high-strength aluminum alloy in the corresponding temper—thereby eliminating costly post-forming heat treatment and consequent distortion of aircraft parts.

R-301 is being produced in three tempers, suitable for a wide range of applications. Inquiries are invited. Reynolds Metals Co., Aluminum and Parts Division, Louisville, Kentucky

Heavy, bending rolls, forming an armor hood for the pilot's compartment. R-301 can be cold-rolled to shape.



R-301 drills and routs to sharp, accurate contour. The hard-surface cladding reduces the hazard of accidental scratching.

REYNOLDS METAL

REYNOLDS ALUMINUM

WALDES TRUARC RETAINING RING

U. S. Patent 18144
Sole manufacturer in U.S.A.

Waldes Truarc presents a significant advance in retaining rings.

This improved retaining ring spreads or contracts without distortion; always retaining its perfectly fitting circular contour.

For thrust load fixing, and shaft and housing applications, Waldes Truarc offers distinct space-saving and material-saving advantages over nuts and bolts . . . plus a stability and dependability heretofore not obtainable in retaining rings.

On request, we will gladly furnish samples and full data for your tests.

WALDES KOH-I-NOOR-INC · LONG ISLAND CITY, N.Y.

Canadian Representatives:
Pronco Progress and Engineering Corporation, Ltd., 72-74 Stafford St., Toronto

GEARGRIND PERFORMS TWO OPERATIONS AT ONCE ...

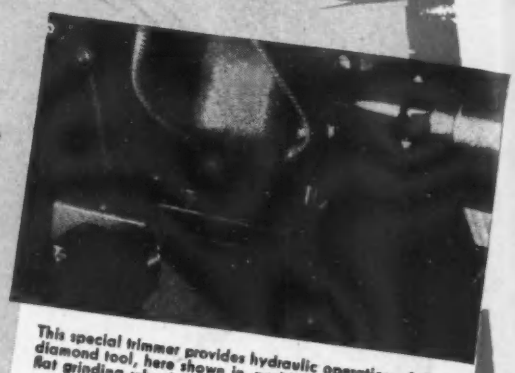
Finish Grinding Time Cut in Half

In grinding an overrunning clutch for an aircraft supercharger part, one GEARGRIND Machine, equipped with dual grinding wheels and a special trimmer, grinds both flat and radius at the same time.

Originally these two operations were performed separately, involving either break-down and set-up when both were performed on the same machine, or the use of two machines on a production basis.

GEARGRIND engineers developed the dual wheel trimmer, while continuing the conventional GEARGRIND method of wheel dressing, using the extended stroke of the table as wheel dressing is required.

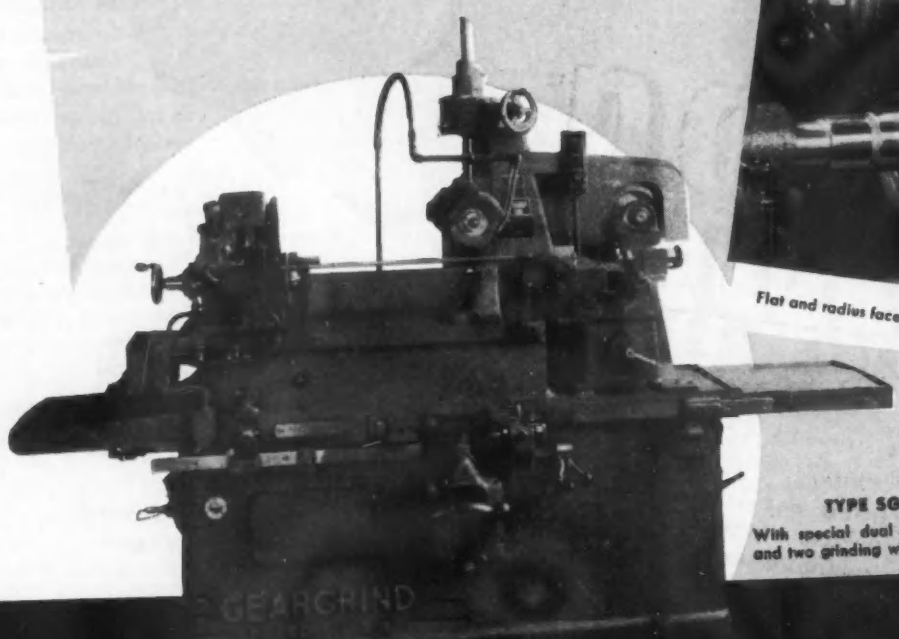
Similar methods may fit into your program, where production, finish and accuracy are vital factors. We shall be glad to discuss the possibilities with you.



This special trimmer provides hydraulic operation of the diamond tool, here shown in position for dressing the flat grinding wheel.

The radius grinding wheel is dressed with the diamond tool in this position.

Flat and radius faces are both ground at the same time.

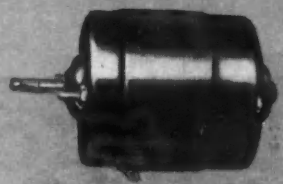


TYPE SG-11
With special dual wheel trimmer and two grinding wheels.

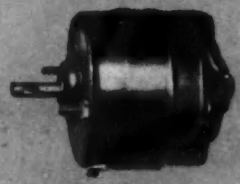
ARMY NAVY

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

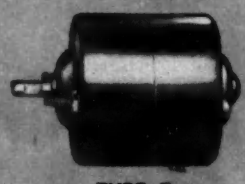
TYPE F



TYPE H



TYPE K



TYPE D

Redmond MICROMOTORS ARE DOING A VITAL JOB FOR INDUSTRY

and they can do the same for you

A WHOPPING parcel of micro-power has been turned out here at Redmond's in the past eighteen years.

Because Micromotors are specialized precision products, they're right in stride for manufacturers who aren't easily satisfied.

Today millions of Micromotors are doing an important job in car heaters, air conditioners, ventilators and space heaters of all types. Out where the fight's going on they're rolling along untiringly the world over.

Expansion at Redmond's to answer the "call" has been a necessary routine for years. Employment has hit 2000. Floor area has grown to more than 5 acres.

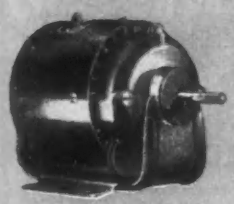
Only basic types of Redmond products are shown on these pages, any one of which may be varied to meet unusual specifications. Flexible production processes permit special voltages, leads, finishes and shaft extensions without interrupting high production and delivery schedules. Samples to meet special requirements are built up and furnished on short notice.

Call us now and get acquainted with this progressive organization that has the ability to get things done in developing micro-power applications.

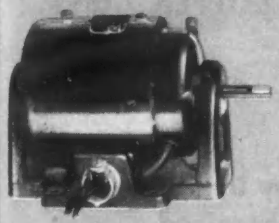
• • •

DC Series and Shunt Wound Micromotors at top of page are built in sizes up to 1/10 hp. for operation at 6 to 115 volts. Shaded Pole Micromotors are built in sizes up to 1/20 hp. and Dynamotors up to 200 watts output.

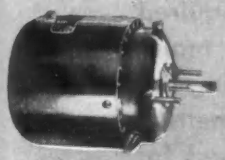
SHADED POLE ENCLOSED TYPES



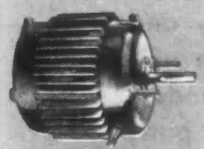
T-110



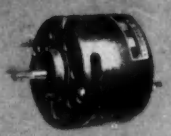
R-110



T-123

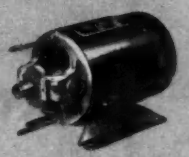


T-121



L-3554 SHADED POLE MICROMOTOR

L-53 SHADED POLE MICROMOTOR



TYPE 4 DYNAMOTOR

TYPE 8 DYNAMOTOR

SPEED CONTROLLER

BLOWER

A. G. Redmond Company

OWOSSO, MICHIGAN

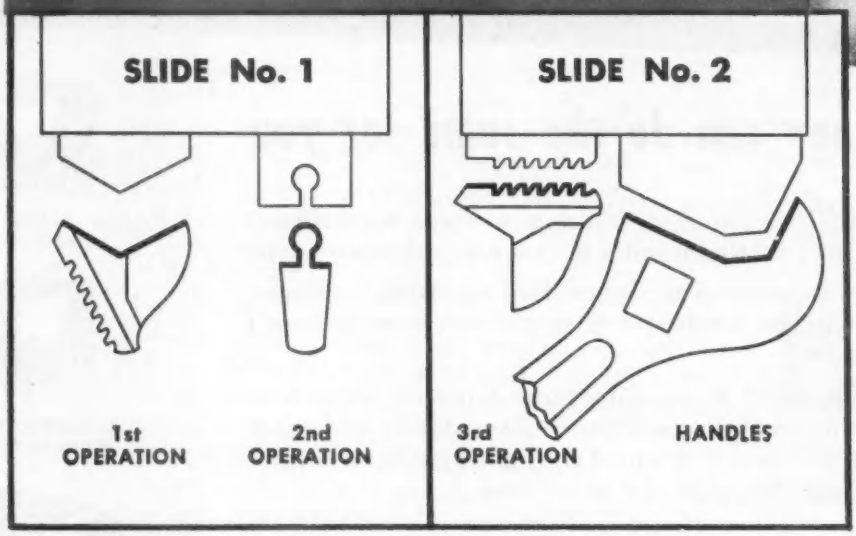
Composite sketch of two plants comprising the Redmond facilities.

REDMOND

BROACHING WRENCHES

3 Times Faster

THAN BY FORMER METHOD



- ★ FEWER MACHINES
- ★ FEWER MEN
- ★ IMPROVED PRODUCT
- ★ MUCH LOWER COST

FIXTURE NO. 1 **FIXTURE NO. 2**

The schematic drawing above shows a set-up designed and built by Detroit Broach Company for broaching several surfaces on adjustable open-end wrenches. These operations are performed on a double slide surface broaching machine using hydraulically operated fixtures. Only one man is required to maintain a production rate three times as great as that formerly maintained using several men and several machines. In addition to increasing the speed of production, two surfaces are machined by the broaching method which were not touched by the former method. This set-up is arranged for broaching several sizes of wrenches.

There are operations in nearly every shop where the speed, accuracy and good finish provided by broaching can increase output and improve efficiency. Call in a Detroit Broach engineer. He will give you complete production and cost data on changing to broaching without obligation on your part.

ARMY E NAVY

DETROIT BROACH COMPANY

20201 SHERWOOD AVENUE • DETROIT, MICHIGAN
9308 SANTA MONICA BLVD. • BEVERLY HILLS, CALIFORNIA

AIRCRAFT-MARINE PRODUCTS INC.

1521-55 N. FOURTH STREET • HARRISBURG, PA.

Telephone: Harrisburg 4-0101

A & M ACCESSORIES, TORONTO, ONTARIO, CANADA

Our hat is in the ring!

IT'S election year here in America. The political campaign is on. But to the manufacturer, 1944 is important for more than political reasons.

The campaign plans for postwar business that you make now—the kind of product you decide to manufacture—will vitally affect your ability to meet competition, to keep your workers busy—yes, even to stay in business.

When it comes to the selection of the materials for your after-the-war product, there will be many worthy candidates competing for your vote—glass, plastics, wood, aluminum, magnesium, and new steels.

The choice will be difficult. It should go to that material, or combination of materials, which will offer to your customers the most for their money, in efficiency, durability and beauty.

U·S·S Steels, whose sphere of application has been vastly increased by the impetus of war research, offer inherent advantages none of these other materials can equal.

Their record is unexcelled for structural strength per unit volume, for toughness, resistance to shock and fatigue, and for versatility of application. No manufacturer concerned about the future can afford to overlook their golden possibilities.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

Steels that meet the challenge of today and tomorrow

U·S·S CARILLOY ALLOY STEELS—S.A.E. and Aircraft Quality Steels for the special jobs of industry.

U·S·S HIGH STRENGTH STEELS to carry high unit stresses and to reduce weight to a minimum at low cost.

U·S·S ABRASION-RESISTING STEELS to combat wear and friction.

U·S·S COPPER STEEL to give twice the atmospheric corrosion resistance of regular steel at little additional cost.

U·S·S HOT-ROLLED AND COLD-ROLLED STEELS to provide the basic advantages of steel, plus maximum economy.

U·S·S STAINLESS AND HEAT-RESISTING STEELS to endure temperatures disastrous to other metals—to resist highly corrosive environments.

USS

ONLY STEEL CAN DO SO MANY JOBS SO WELL

UNITED STATES STEEL

BETTER COMMUTATION COMES FROM DEVELOPMENTS IN

High Altitude Brushes

FOR EARTH-SURFACE MACHINES

To meet a critical problem on high altitude planes—rapid failure of generator brushes at altitudes above 30,000 feet—Westinghouse Research Engineers developed a specially treated electrographitic brush.

Details of the treatment must remain secret, but its purpose is to form a film on the commutator—a film which is normally present on earth-surface machines, but which was rapidly destroyed by the thin, dry air of the stratosphere. This caused a "grindstone" effect between commutator and brushes, resulting in extremely rapid brush wear.

This development has particular significance to every user of commutating machines because:

(1) Its success in improving commutation under the tough conditions of high altitude flying has led to its application to earth-surface machines.

(2) It promises to have wide application where machines must operate in atmospheres contaminated by corrosive fumes or gases.

Tests have shown that through the use of this brush, commutator condition can be materially improved, regrinding greatly reduced, and brush life lengthened.

We welcome inquiries on your commutation problems—and our engineers are available to assist with tests. Contact your nearest Westinghouse office, or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. J-90527

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

The Machine of Tomorrow— TODAY!

Sav-way SPITFIRE

ELECTRO-HYDRAULIC INTERNAL GRINDER

Modern Functional Design Throughout

★

Neoprene Insulated

★

Famous Gold Seal Spindle

★

Electrically-Operated Diamond Wheel Dresser

Ready ahead of time—the Sav-Way MH-1 combination hand and electro-hydraulic internal grinder. 5/32″ minimum table stroke! Gatling gun table speed, through the use of aircraft-type micro-limit switches and solenoid-operated valves. Electrical, automatic, adjustable cross feed. Dozens of outstanding features! It's a postwar machine—ready now to help speed today's war production! Its low cost will surprise you.

Sav-way INDUSTRIES
Machine Tool Division
BOX 117, HARPER STATION, DETROIT 13, MICH.

Send for Actual Photographs, Specifications, and Prices

BUILDERS OF HAND AND HYDRAULIC INTERNAL GRINDERS • PRODUCERS OF GOLD SEAL SPINDLES
PLUG GAGES • MICROMETER CHECKERS • PRECISION AIRCRAFT, AUTOMOTIVE, AND ORDNANCE PARTS

THEN TRACTOR-TRAILERS WILL BE

Braked Electrically

IT was a surprise dawn attack! Scores of huge artillery pieces were wheeled into position down tortuous mountain slopes and over the punishing deserts of Africa. Tons of guns always under complete control—eased along or stopped short by Warner Electric Brakes. Yes, modern tractor-trailers and many other types of power equipment will be *braked electrically* after the war. Warner Electric Brakes, performance-proved on thousands of essential motor transports and artillery pieces in grueling war service all over the world, will be available for a wide range of new applications.

Warner Electric Brake Mfg. Co.
Beloit, Wisconsin

BUY WAR BONDS

WARNER
ELECTRIC BRAKES

CONTROLLED SPLIT-SECOND STOPPING POWER FOR ANY PURPOSE

"One Pound Saved Can Earn $180.00 a Year"

SAYS BRUCE E. BRAUN
Vice President, Operations
Chicago and Southern Air Lines
"In carrying a 200-lb. passenger on a round-trip schedule from Chicago to New Orleans, the revenue to us would be $93.28. Translated into per pound revenue, this is approximately $.50. If we save one pound each day throughout the year, the saving would amount to $180.00. We are very much interested in the post-war use of Boots Self-Locking Nuts. Through their application on Chicago and Southern planes we will be able to capitalize their pronounced weight-saving characteristics."
CHICAGO & SOUTHERN
NC 25627

Send for Free Boots Weight-Saving Booklet Today—Actual weights of over 250 different self-locking nuts used in aircraft, comprehensively reviewed for the convenience of aircraft designers, engineers, operating and maintenance personnel. Copy will be sent you, free, on request.

Boots Steel Anchor Nut

(W2S #8-32) This all-metal, self-locking nut is 60% lighter than a comparable fibre nut.

UP TO 60 LBS. PER PLANE SAVED BY BOOTS NUTS

- Being *all* metal, they are TOUGHER and SAFER.
- Can be used over and over again.
- "Outlast the plane."
- Now standard fastenings on *every* type of military aircraft.
- Will be standard on commercial planes after victory.
- Approved by all government aviation agencies.

BOOTS **SELF-LOCKING NUTS**

"They Fly With Their Boots On—Lighter"

Boots Aircraft Nut Corporation, General Offices, New Canaan, Conn. Dept. H

NO MORE GREASY SPOTS ON YOUR BODY INTERIORS!

IT will no longer be difficult to remove grease spots from the interior surfaces of a car body when they are covered with Formica. The swish of a cloth will take care of it.

For this dense, non-porous material is no more absorptive than glass and just as easy to clean.

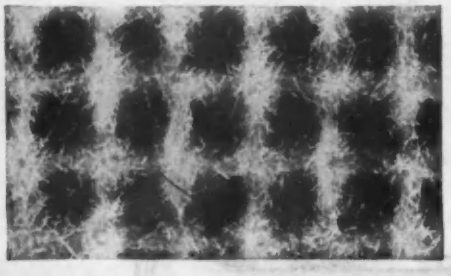
Its satiny finish, in a wide range of colors and patterns, provides the most modern and attractive of effects. And it is so simply and easily handled by standard methods that these plastic interiors can be included in your first After-the-War models. This much of "the car of the future" you can deliver at once.

Let our engineers give you all the details.

FORMICA

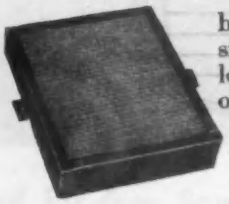
THE FORMICA INSULATION COMPANY
4612 Spring Grove Avenue, Cincinnati, O.

FLOCKED WIRE MEDIA



This microphotograph of a small section of Air-Maze aircraft filter media shows some of the millions of tiny wicks that continually feed adhesive to the surface and maintain dust-arresting efficiency.

This media, developed by Air-Maze, made possible the high velocity low-resistance filtration of today's aircraft filters.



★

Typical Air-Maze Aircraft Filter—Send for Bulletin No. 113.

One of the six measurements of aircraft engine air filters

★ Aircraft engineers are used to working both ends against the middle. This ability is spot-lighted in designing both high efficiency and low restriction into aircraft engine air filters.

For 100% efficiency, you could block the intake with a solid plate . . . having, unfortunately, 100% restriction. On the other hand, you can get zero restriction—and zero efficiency, too—by leaving the filter out.

Between the two extremes, you'll find that Air-Maze engineers, working closely with the aircraft industry for more than 17 years, have found the answer.

Air-Maze air filters today combine the highest efficiency in their history with the low restriction so vital to maximum engine performance under all conditions.

Our engineers will be glad to work with you in balancing all the factors on our "yardstick" to meet your particular needs.

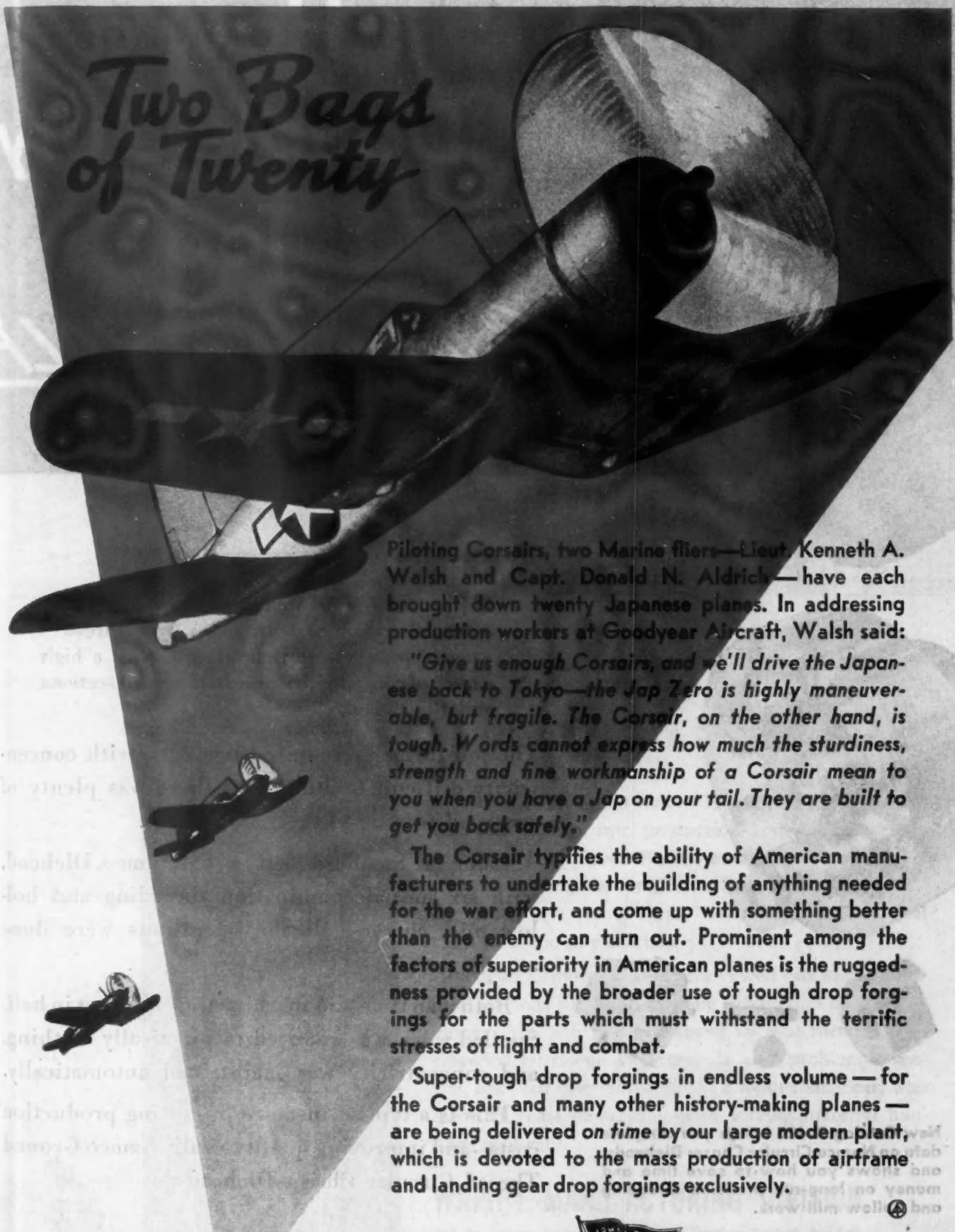
AIR-MAZE CORPORATION • *Engineers and Manufacturers* • **CLEVELAND 5, OHIO**

Representatives in Principal Cities • *In Canada:* Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver, B. C.

ARMY E NAVY

AIR-MAZE

SPECIALISTS IN AIR FILTRATION



Piloting Corsairs, two Marine fliers—Lieut. Kenneth A. Walsh and Capt. Donald N. Aldrich—have each brought down twenty Japanese planes. In addressing production workers at Goodyear Aircraft, Walsh said:

"Give us enough Corsairs, and we'll drive the Japanese back to Tokyo—the Jap Zero is highly maneuverable, but fragile. The Corsair, on the other hand, is tough. Words cannot express how much the sturdiness, strength and fine workmanship of a Corsair mean to you when you have a Jap on your tail. They are built to get you back safely."

The Corsair typifies the ability of American manufacturers to undertake the building of anything needed for the war effort, and come up with something better than the enemy can turn out. Prominent among the factors of superiority in American planes is the ruggedness provided by the broader use of tough drop forgings for the parts which must withstand the terrific stresses of flight and combat.

Super-tough drop forgings in endless volume — for the Corsair and many other history-making planes — are being delivered *on time* by our large modern plant, which is devoted to the mass production of airframe and landing gear drop forgings exclusively.

Member of the A.C.C.A.

Kropp Forge Aviation Co.

5301 W. ROOSEVELT ROAD CHICAGO

Engineering Representatives in Principal Cities

How a Double Duty Tool

Cuts time in HALF

Here was the problem:

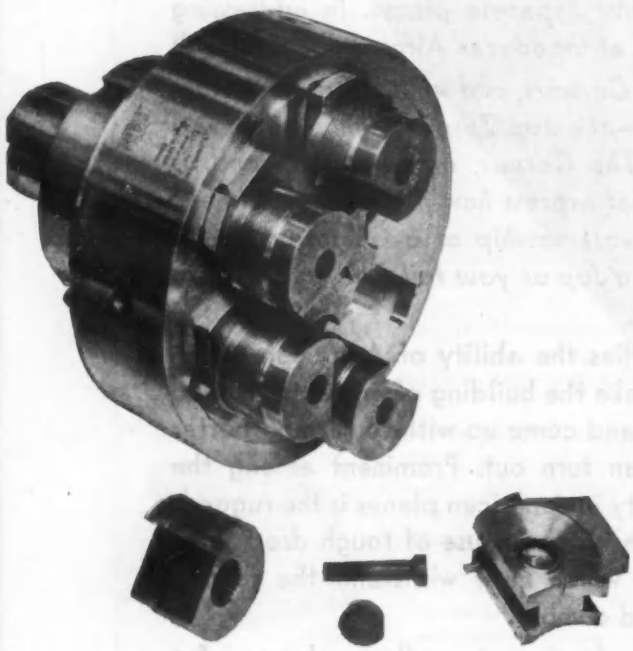
3¼" seamless steel tubing to be threaded with a turned section at both ends of the thread—gauge-type, pressure tight thread, with a high degree of concentricity over both turned sections and the thread.

The job formerly required two cuts, with concentricity difficult to attain and there was plenty of scrapped work.

Using a Standard DR 4⅞" Namco Diehead, with six special combination threading and hollow mill chasers, all the operations were done at one pass.

Both man time and machine time were cut in half. Spoiled work was reduced to practically nothing, and concentricity was maintained automatically.

This is a typical instance of cutting production costs—and improving quality—with Namco Ground Thread Circular Chaser Dieheads.

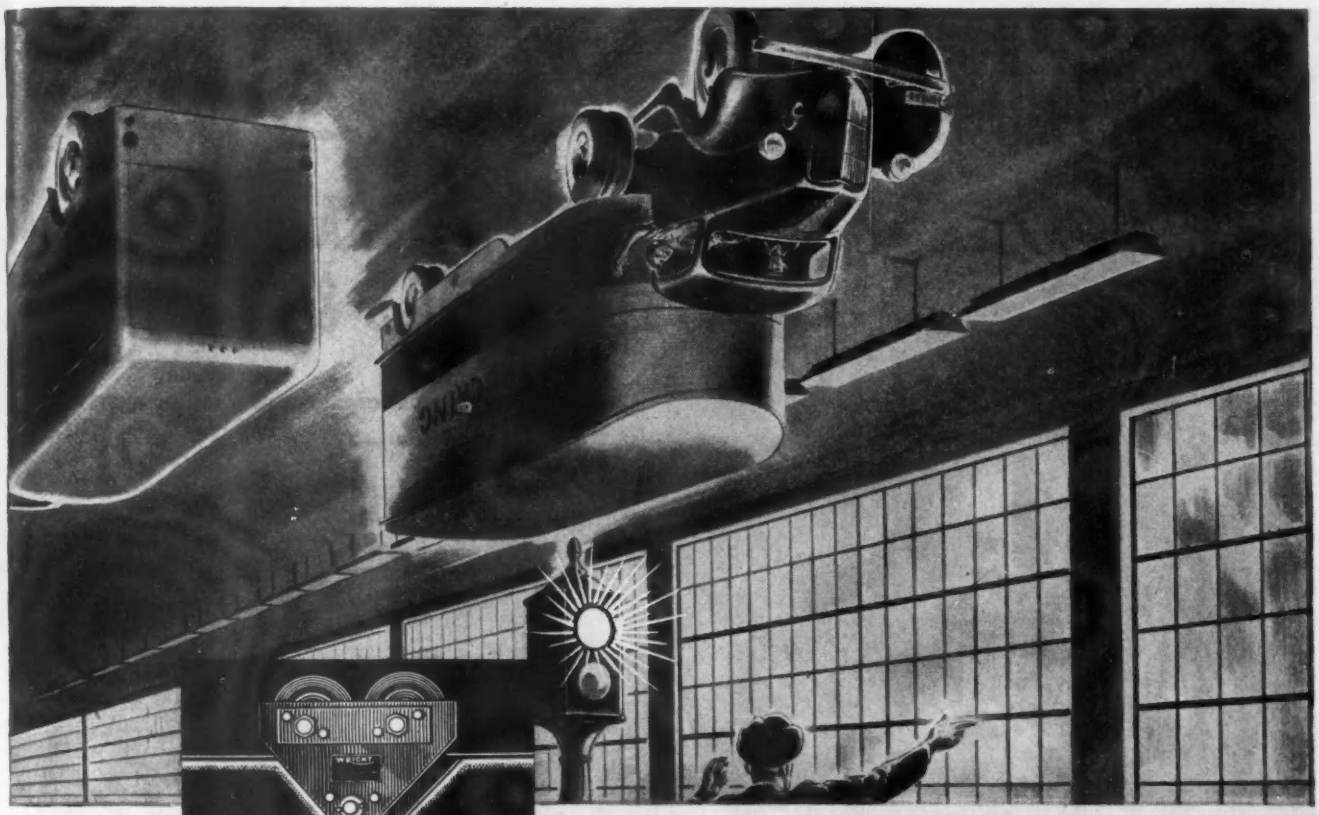


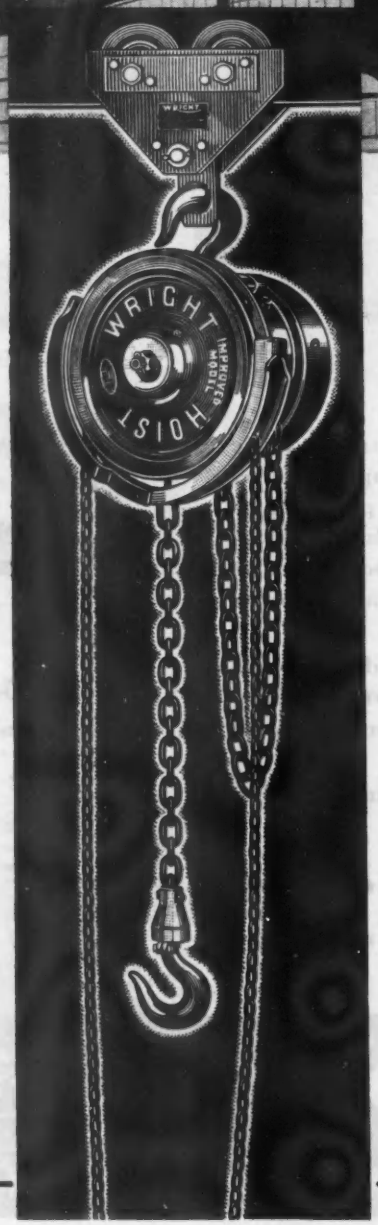
New Catalog D-42B brings you complete data on Namco Circular Chaser Dieheads, and shows you how to save time and money on long-run precision threading and hollow mill work.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING





WRIGHT MAKES HIGHWAYS OF THE SKYWAYS OF YOUR PLANT

WRIGHT engineers (and **WRIGHT** Hoists and Cranes) convert idle ceilings into production boulevards. **WRIGHT** Improved High Speed Hoists, **WRIGHT** *Speedway* Electric Hoists, and **WRIGHT** Cranes have long made possible fast, safe, economical, horizontal and vertical transportation of materials.

Your local **WRIGHT** distributor is well qualified to suggest methods for both speeding production and saving money. You will find him listed in your metropolitan classified telephone directory. If your problem is special, ask your distributor to call a **WRIGHT** engineer, who has had years of experience in solving material handling problems.

WRIGHT MANUFACTURING DIVISION

York, Pa., Chicago, Denver, Los Angeles, San Francisco, Portland, New York

AMERICAN CHAIN & CABLE COMPANY, INC.

BRIDGEPORT - CONNECTICUT

ACCO

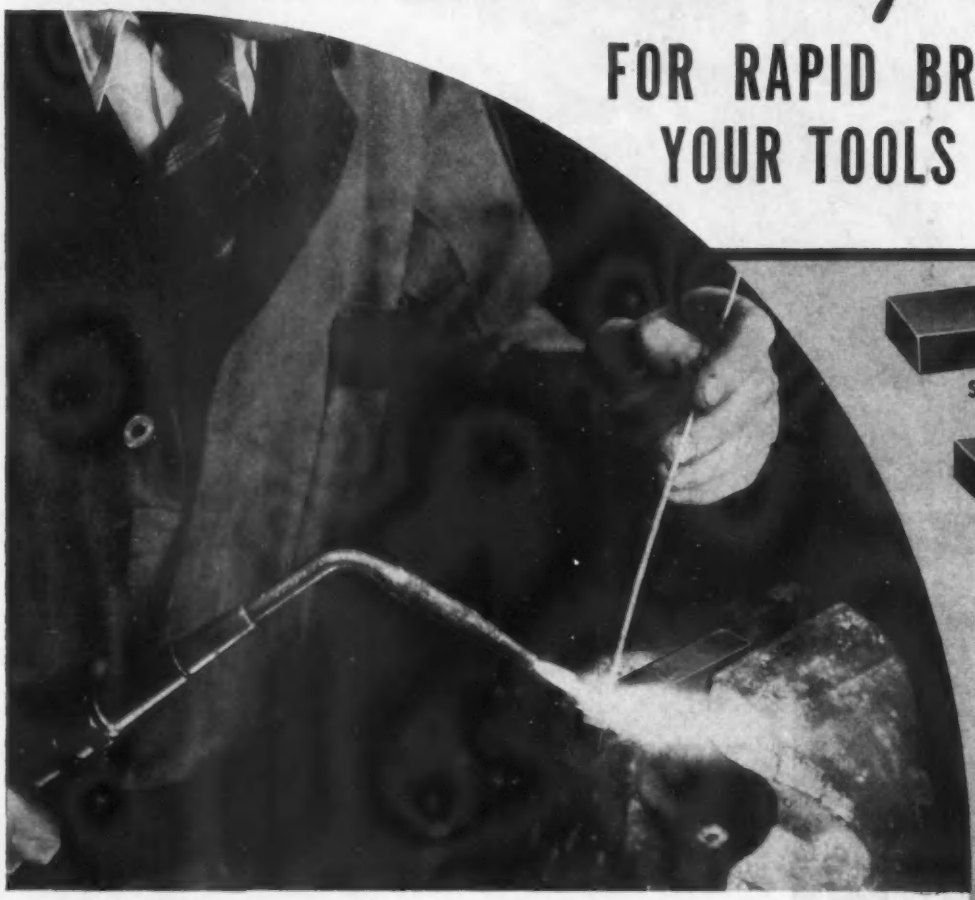
In Business for Your Safety

ARMY E NAVY

FLYING OVER THE WRIGHT HOIST PLANT

STANDARD *Carboloy Blanks*

FOR RAPID BRAZING TO YOUR TOOLS & CUTTERS



For convenience, economy, flexibility, many plants maintain a basic stock of standard Carboloy Blanks in their tool cribs for rapid brazing to tool and cutter shanks. In this way your plant can be prepared to rapidly tool-up special jobs on a moment's notice. A worthwhile safeguard to provide for emergency tooling. Handy, too, for quickly repairing cutters damaged through accidental abuse, and for salvaging worn-out high speed steel cutters.

Prompt deliveries from stock. Styles as shown, in wide range of sizes. For cutting steel, cast-iron, non-ferrous and non-metallics. Brazing instruction manual free on request. Training film strip also available, at print cost of $3.50.

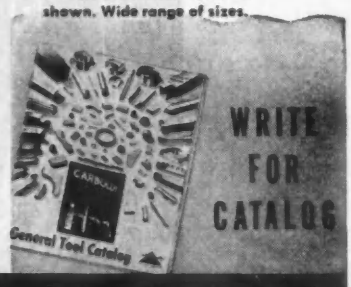
Be prepared for all requirements. Keep a stock of standard Carboloy Blanks on hand. Write for catalog GT-175.

CARBOLOY COMPANY, INC.
11151 E. 8 MILE ROAD, DETROIT 32, MICHIGAN
Birmingham · Chicago · Cleveland · Los Angeles · Newark · Philadelphia · Pittsburgh · Seattle · Thomaston, Conn.

Also available through 22 leading mill supply distributors

In Stock

Prompt deliveries. Styles as shown. Wide range of sizes.



CARBOLOY

TRADEMARK

For Cutting CAST IRON and Non Ferrous Metals

For Cutting STEEL

TUNGSTEN CARBIDES ★ ★ ★ TUNGSTEN CARBIDES WITH TANTALUM AND/OR TITANIUM CARBIDES

INTERIOR OF VELON*

EYE-APPEAL

DURABILITY

PRACTICALITY

IMAGINE SHOWING THE INSIDE OF THE CAR FIRST!

Change or no change *outside* the first postwar cars, there can be a startling change *inside!*

*Velon** makes *practical* all the color and richness you've wanted for upholstery—to match or contrast with the exterior.

With *Velon* upholstery, the brightest blue will *stay* bright blue; the lightest lavender will stay like new.

Velon is color-fast. It's tough. It's stainless. It's virtually 100% non-absorbent. *Velon* fabrics can be wiped clean and dry in a minute —look as fresh and colorful as new.

And as far as we know, *Velon* never wears out. Thousands of prewar installations in public vehicles continue today to bear the heavy burden of wartime traffic—dramatic testimony to *Velon's* almost unbelievable resistance to use and abuse.

If you can't change the outside of your 194X models, at least you can plan with confidence on modernizing the interior—adding the new beauty and sales appeal of "Interior of Velon."

P.S. For ultra-modern seating, make the cushioning FOAMEX.

ANOTHER CONTRIBUTION TO A BETTER WAY OF LIFE *by*

Firestone

For the finest in music, listen to the Voice of Firestone, Monday evenings over the entire NBC Network.

*Trademark • pronounced VEL-LÓN

They come out shooting!

Of course, they were built to come out shooting but, during countless miles over water in cargo holds, corrosion might have attacked and destroyed their power!

Sealing out the elements that cause corrosion is the No. 1 job of MYSTIK *Waterproof* Self-Stik Cloth Tape. How well it does its job is proved by the hundreds of major producers of war materiel—ordnance, food and medicine—using MYSTIK as an approved means to protect the condition and quality of their products from factory to the point of actual use.

Investigate the application of Mystik Self-Stik Cloth Tape to your problems of product protection.

A request on your letterhead will bring you a sample roll. Address: Department AI, MYSTIK TAPE DIVISION, Chicago Show Printing Co., 2635 No. Kildare Ave., Chicago 39.

• • •

MYSTIK Self-Stik Cloth Tape is the result of nine years of development of pressure-sensitive adhesive products, originating with the famous MYSTIK "Oil-change" sticker, widely used by major oil companies and automotive manufacturers.

NEW MIRACLE SAW

Cuts Magnesium, Aluminum and Non-Ferrous Metals

Faster!

● A stumbling block to industry's use of non-ferrous metals during the important war years has been the difficulty of cutting them rapidly.

Now that problem is solved by the new DoALL Buttress Band Saw, developed in the DoALL Research Laboratory to cut Magnesium, Aluminum, Zinc, Brass, Copper, Manganese Bronze, Tempoloy Bronze, Gray Cast Iron, Kirksite, Wood, etc.

MAGNESIUM

Approximate size 10 x 12 x 18". Cut at the rate of 100 square inches per minute with this new DoALL Buttress—5 to 7 times faster than with usual metal saws.

ALUMINUM

Riser Rings from Ford Castings, non-heat treated. Cut at the rate of 90 square inches per minute. The new DoALL Buttress lasted for 108 cuts, a production increase of 400%.

SILICON ALUMINUM—30 to 33 square inches per minute.

14 ST ALUMINUM—24 square inches per minute.

ALUMINUM ARMOR PLATE 5/16"—25 to 30 lineal feet per minute.

ALUMINUM 24 ST 1"—160 square inches per minute.

DoALL Buttress — THE NEW WIDE-SPACED HARD TOOTH SAW — TRADE MARK REG

The spectacular new band saw that has been tried out recently in a dozen large aircraft and other war plants with unheard-of-before results. Not only does smoother cutting, but does the work in 1/10 to 1/5 the former time. Fits any band sawing machine.

NO SHARPENING REQUIRED

Use the DoALL until worn out, then insert a new saw.

IMMEDIATE DELIVERY from all our Supply Points. Write for Literature and Prices.

DoALL

INDUSTRY'S NEW SET OF TOOLS

Send for Illustrated Literature

THE DoALL COMPANY

202 N. LAUREL ST. • DES PLAINES, ILL.

Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Rochester, Rockford, St. Louis, San Francisco, Seattle, Toledo, Tulsa, West Hartford.

THESE, TOO, ARE EAGLES...

America and the world can never forget the tremendous contribution Trucks and Truckers have made in giving the United Nations the undisputed air supremacy enjoyed today on every front ★ That the great majority of this essential hauling was accomplished by an overburdened, undermanned Motor Transport Industry speaks volumes not only for the men who engineered the task but for the ruggedness of American equipment ★ Although there has never been a question of their ability to come through, it has been an honor for Bendix-Westinghouse Air Brakes to have served, both men and equipment, so faithfully throughout this emergency. In this service, both civil and military, the safe, dependable, economic performance of this "World Standard of Safety" was never more conclusively proven ★ If you have a control problem, may we suggest that there is no better time to see your Bendix-Westinghouse Distributor who will be happy to confer with you, without obligation. It's a coast-to-coast service maintained in the interest of better, safer, more economical transportation, by the two greatest names in braking.

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY . . . ELYRIA, OHIO

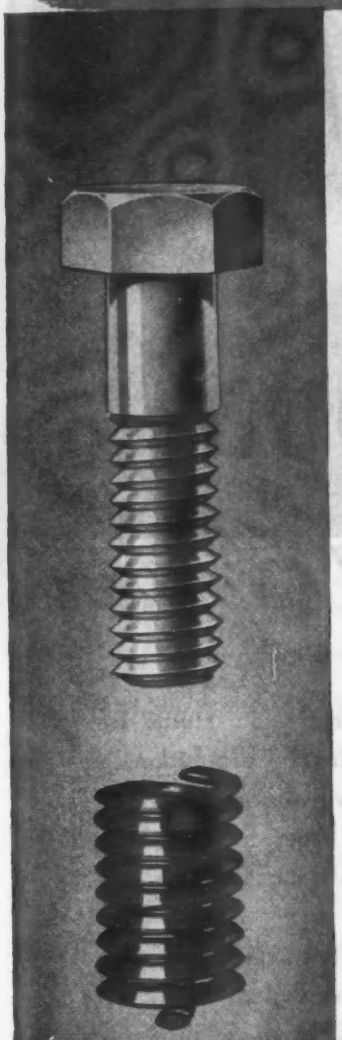
Bendix-Westinghouse

AIR BRAKES

AND PNEUMATIC CONTROL DEVICES

IT IS SIGNIFICANT THAT AMERICA'S FINEST MOTOR TRUCK FLEETS ARE EQUIPPED WITH BENDIX-WESTINGHOUSE AIR BRAKES

Heli-Coil Inserts
MAKE ALUMINUM TAPPED THREADS
Wear Like Iron!



"Heli-Coil" Screw Thread Inserts give the protection of steel to light metal products at the points where they are most vulnerable to wear—in holes tapped for threaded fastenings.

Made of precision-shaped helical coils of stainless steel or phosphor bronze wire, these Inserts are installed in holes tapped for the American National System.

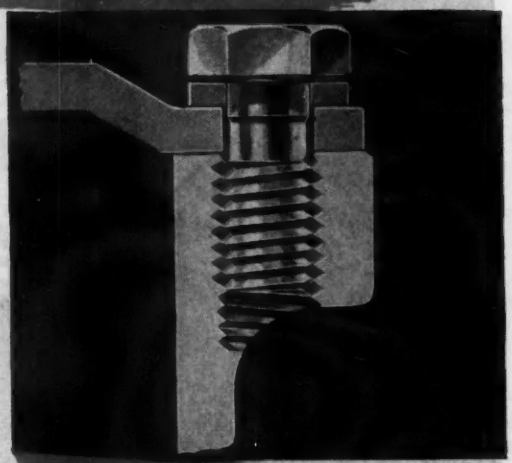
Then, when the holding screw or stud is inserted, its entire wearing action is on the hard metal Insert, instead of on the soft metal boss. The light metal threads are armored against abrasion, stripping and seizing. The entire assembly is protected against serious breakdowns in the field.

The wide acceptance of "Heli-Coil" Inserts by the aircraft industry—today's top user of light metals—gives promise of their unlimited usefulness throughout all industry after the war.

Wherever holes must be tapped in light metal parts, "Heli-Coil" Inserts fight friction, help build a stronger, lighter product. They may well be the answer to some of your problems. Send for detailed literature today.

THE SCREW SYSTEM WITH THE ANTI-FRICTION THREAD LINING!

U. S. and Foreign Patents Issued and Pending



Heli-Coil INSERTS
ARE USED FOR ORIGINAL INSTALLATIONS IN ARMY, NAVY AND TRANSPORT AIRCRAFT ENGINES, ACCESSORIES AND PARTS

ALSO FOR SALVAGE, MAINTENANCE AND FIELD SERVICING OPERATIONS

Heli-Coil INSERTS SAVE

TIME
Can be installed with power tools in a fraction of the time required for solid screw bushings.

WEIGHT
Weigh one-fifth as much as screw bushings of the same diameter.

SPACE
Occupy less than half as much cross sectional area as solid bushings, permitting more latitude in design.

METAL
Made from precision-shaped wire with no waste, require about one-tenth as much metal as solid bushings made from bar stock.

AERO-THREAD

AIRCRAFT SCREW PRODUCTS COMPANY, INC.
47-23 35th STREET • LONG ISLAND CITY, 1, N.Y.

LIFE BLOOD

for Aircraft Controls

TYPE AND GRADES	TYPE AND GRADES
Whiz Castor Oil Base Type Grade C—Light Grade A—Heavy	Whiz Petroleum Base Type Grade L—Light Grade M—Medium
INDICATED USES	**INDICATED USES**
Used primarily in hydraulic braking systems, shock absorbers, strut shocks, retractable landing gears. Other mechanisms where specified.	For use in automatic pilots. Other mechanisms where specified.
CHARACTERISTICS	**CHARACTERISTICS**
Non-gumming, provides maximum lubrication and correct viscosity. Maintains stable fluidity. Grade C for sub-zero temperatures. Grade A for warmer climates.	Non-gumming. Non-corrosive—will not damage metal or synthetic rubber parts. Maintains stable fluidity. Grade L for temperatures down to —60°F.; will not thicken, congeal, or freeze. Grade M designed for use at temperatures of —50°F. and higher.

Several important types of Whiz Hydraulic Fluids are manufactured by R. M. Hollingshead Corporation, a major supplier for Army and Navy aircraft. Of these fluids, two types are currently in great demand. Both conform fully to Government specifications and each is supplied in two grades.

Your inquiries about these hydraulic fluids will receive prompt attention. Our engineers will gladly work directly with yours in designing special chemical products to meet unusual requirements. *R. M. Hollingshead Corporation, Camden, N. J.; Toronto, Canada.*

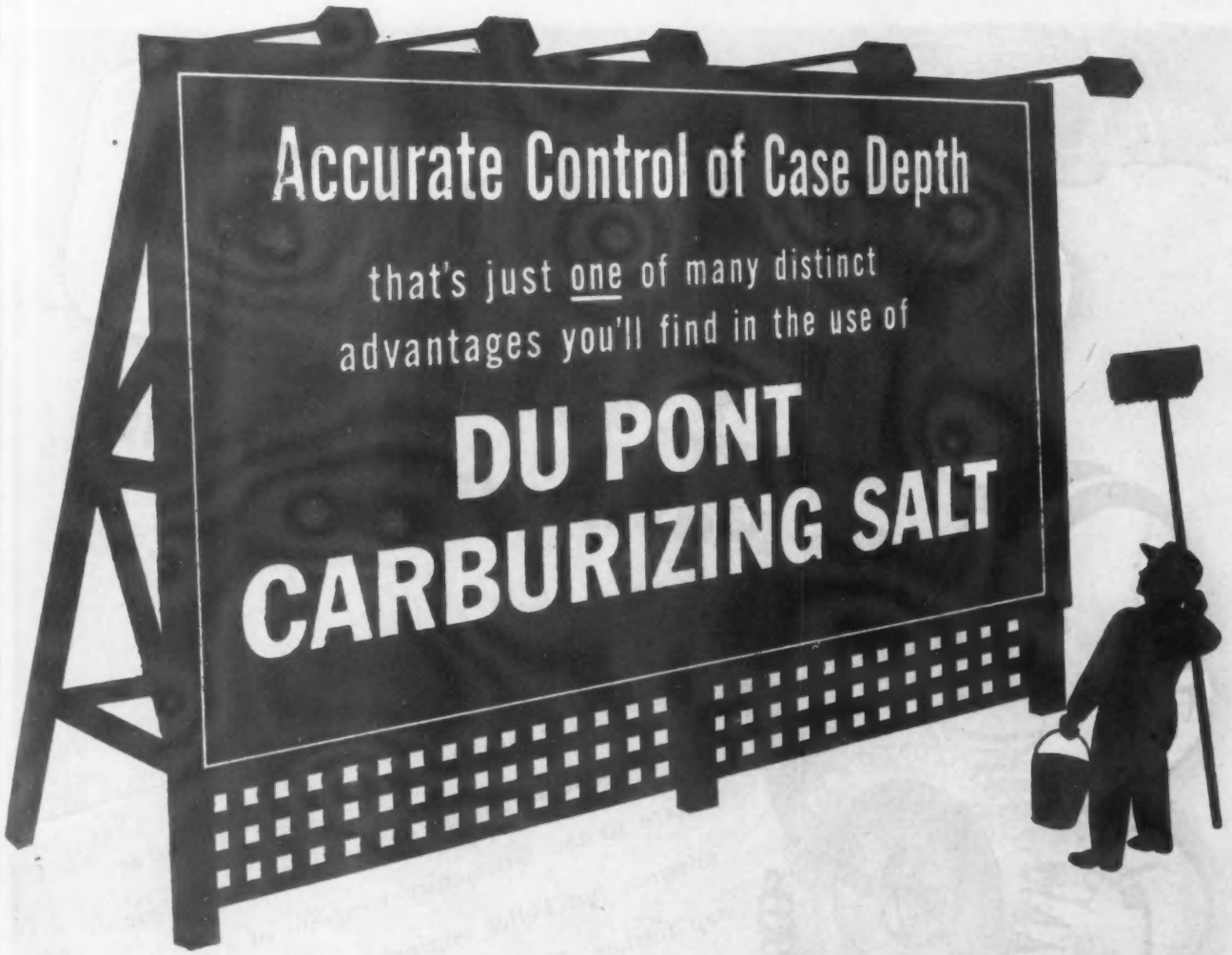
BUY MORE WAR BONDS!

Whiz

Hollingshead

LEADER IN MAINTENANCE PRODUCTS

Also makers of Whiz Rust Preventive Compounds, Compounded Lubricants, Lubricating Oils, and Cleaning Compounds for Aircraft.


Accurate Control of Case Depth
that's just one of many distinct
advantages you'll find in the use of
DU PONT
CARBURIZING SALT

It's easy to control both depth and carbon content of the case when you use Du Pont Carburizing Salt for case hardening. Helps cut production time and costs.

Too, you get *deep* high-carbon, low-nitrogen cases at from 1650° to 1750°F, equivalent to those produced by pack and gas hardening. And the baths are stable above 1700°F.

Skilled metallurgists in our laboratories and in the field will help you select the *right* materials from Du Pont's complete line to meet your requirements. Write: E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Dept., Wilmington, Del.

LET'S ALL BACK THE ATTACK!

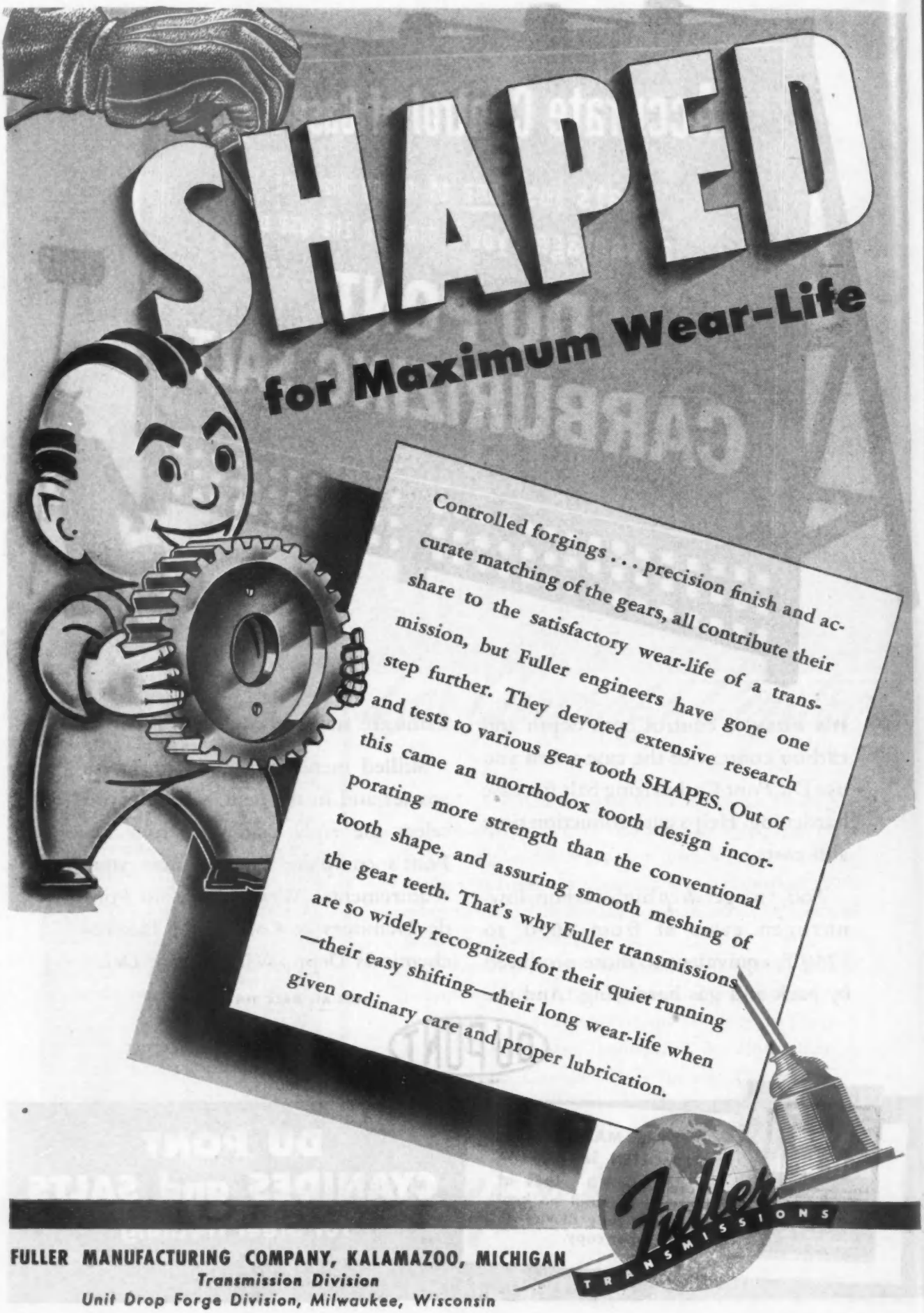
DU PONT

FREE MANUAL ON MOLTEN SALT BATHS

More than 70 pages of practical material on heat treatment, fully illustrated. Ask for your copy.

DU PONT CYANIDES and SALTS for Steel Treating

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY


SHAPED
for Maximum Wear-Life
Controlled forgings . . . precision finish and accurate matching of the gears, all contribute their share to the satisfactory wear-life of a transmission, but Fuller engineers have gone one step further. They devoted extensive research and tests to various gear tooth SHAPES. Out of this came an unorthodox tooth design incorporating more strength than the conventional tooth shape, and assuring smooth meshing of the gear teeth. That's why Fuller transmissions are so widely recognized for their quiet running —their easy shifting—their long wear-life when given ordinary care and proper lubrication.
Fuller
TRANSMISSIONS

FULLER MANUFACTURING COMPANY, KALAMAZOO, MICHIGAN
Transmission Division
Unit Drop Forge Division, Milwaukee, Wisconsin

DISTINGUISHED BY ACCURACY TO SIZE

JESSOP STEELS Centerless Ground

Jessop Centerless Ground Bars are furnished to customers' specifications, both as to finish and tolerances. They are free from all surface defects and decarburization.

Jessop Steels, Centerless Ground are available in all analyses for High Speed, Alloy and Carbon Tool Steels, Stainless and Valve Steels. Sizes range from ¼" to 2-⅛" rounds. Jessop Stainless and Tool Steels are also available Cold Drawn in sizes from ½" to 4".

JESSOP STEEL COMPANY

Head Office and Works

WASHINGTON, Penna.

★ ★ ★

Warehouses:

CHICAGO · CINCINNATI · CLEVELAND
DETROIT · HARTFORD · MONTREAL · TORONTO

Established 1901

JUST TO BRING YOU UP TO DATE ON *PUSH*-PULL CONTROLS . . .

● They said it couldn't be done. It *had* to be done. So it *was* done . . . That's the story of development in automotive—in aircraft—in a thousand other American industries. And it's the story of **TRU-LAY PUSH-PULL CONTROLS**. They've been *improved* right along with aircraft, tanks, trucks, guns, other front-line fighting equipment. War-born improvements will qualify PUSH-PULL CONTROLS to meet many new post-war requirements. If you have in mind any particular problem in remote control, we will be glad to give you detailed information about specific applications.

HIGHLIGHT FACTS ABOUT PUSH-PULL

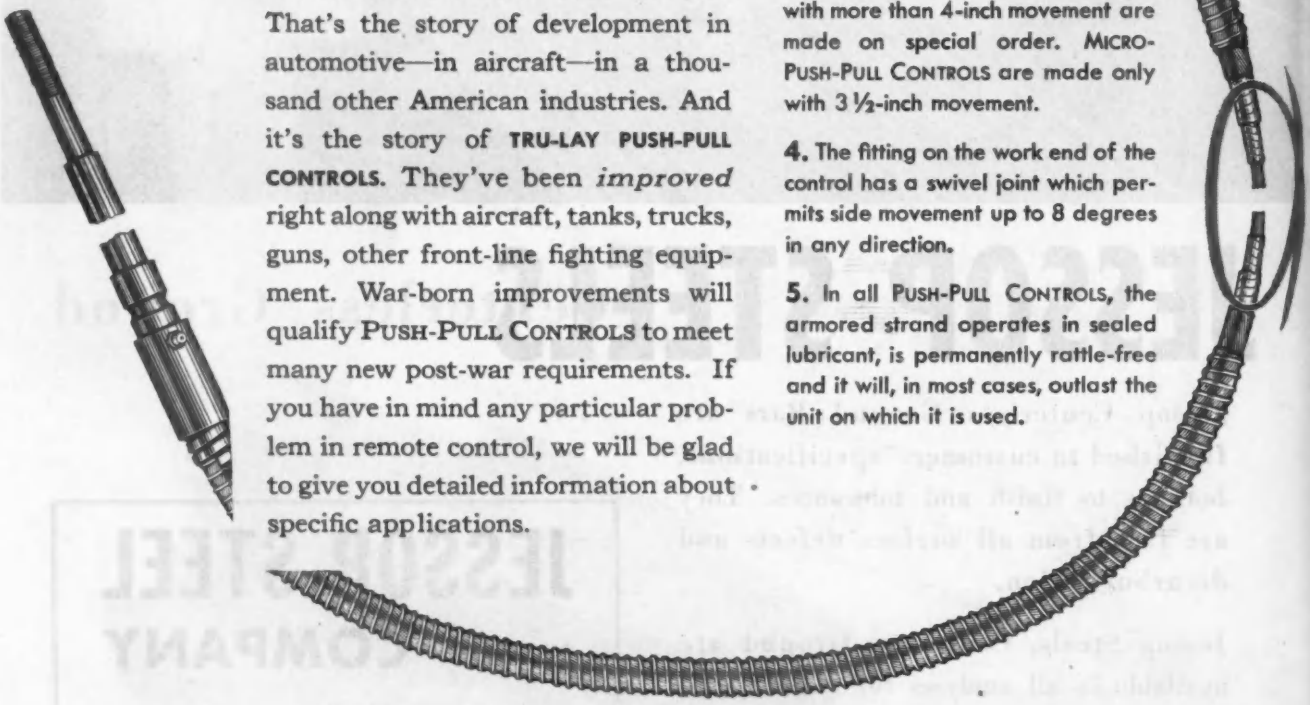
1. The operating member of a PUSH-PULL CONTROL is an armored strand of preformed cable. These cables are made in 3 sizes: 1/8", 3/16" and 1/4".

2. There are three types of PUSH-PULL CONTROLS, governed by the fitting at the head or input end. The REGULAR allows for manual adjustment any place between the "ON" and "OFF" positions. MICRO-PUSH-PULL permits micro-adjustment, either forward or back, from any point in the range of the control. FIXED POSITION CONTROL provides quick, exact adjustment to two or more fixed positions.

3. REGULAR and FIXED POSITION PUSH-PULL CONTROLS are made in any length and are standard with movement of 1, 2, 3 or 4 inches. Units with more than 4-inch movement are made on special order. MICRO-PUSH-PULL CONTROLS are made only with 3 1/2-inch movement.

4. The fitting on the work end of the control has a swivel joint which permits side movement up to 8 degrees in any direction.

5. In all PUSH-PULL CONTROLS, the armored strand operates in sealed lubricant, is permanently rattle-free and it will, in most cases, outlast the unit on which it is used.



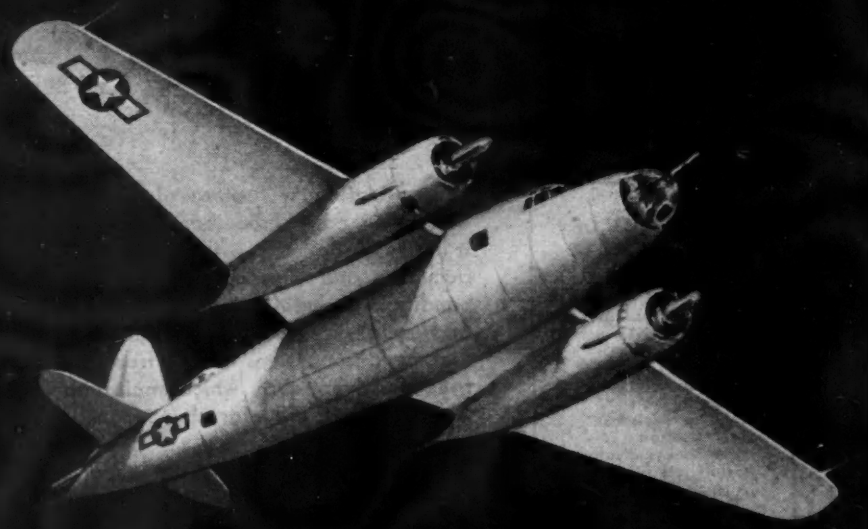
PUSH-PULL AUTOMOTIVE CONTROLS

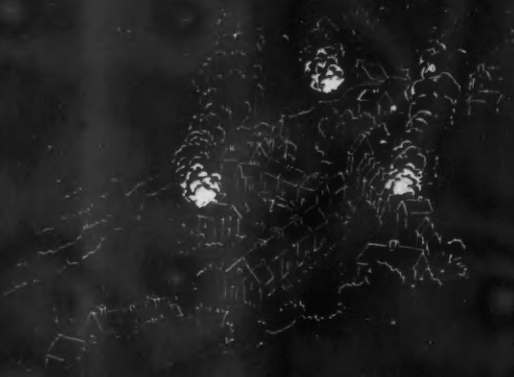
AUTOMOTIVE AND AIRCRAFT DIVISION
6-235 GENERAL MOTORS BUILDING, DETROIT 2 • 695 BRYANT STREET, SAN FRANCISCO 7
AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT • CONNECTICUT
In Business for Your Safety

Also manufacturers of TRU-STOP Emergency BRAKES—with ventilated discs that dissipate the heat of braking.

WAR PLANES USING AMERICAN HAMMERED PISTON RINGS

A-20 Havoc
A-22 Maryland
A-24 Dauntless
A-25 Shrike
A-29 Hudson
A-30 Baltimore
A-31 Vengeance
A-34 Buccaneer
A-36 Invader
B-17 Flying Fortress
B-18 Bolo
B-23 Dragon
B-24 Liberator
B-25 Mitchell
B-26 Marauder
B-29 Superfortress
B-34 Ventura
C-43 Traveler
C-45A Voyager
C-46 Commando
C-47 Skytrain
C-53 Skytrooper
C-54 Skymaster
C-56 Lodestar
C-61 Forwarder
C-69 Constellation
C-76 Caravan
C-87 Liberator Express
J-4-F Widgeon
L-1 Vigilant
L-2 Hedgehopper
L-3 Grasshopper
L-4 Grasshopper
L-5 Sentinel
O-52 Owl
P-40F War Hawk
P-43 Lancer
P-47 Thunderbolt
P-51B Mustang
P-61 Black Widow
P-66 Vanguard
AT-6 Texan
AT-7 Navigator
AT-8 Bobcat
AT-9 Jeep
AT-10 Wichita
AT-11 Kansas
AT-13 Yankee Doodle
AT-14 Yankee Doodle
AT-15 Crewmaker
AT-17 Bobcat
AT-19 Reliant
BT-13 Valiant
BT-15 Valiant
PT-13 Caydet
PT-17 Caydet
PT-19 Cornell
PT-22 Recruit
PT-26 Cornell
F2A Buffalo
F4F Wildcat
F4U Corsair
F6F Hellcat
N2T Tutor
OS2U Kingfisher
PBM Mariner
PBY Catalina
PB2Y Coronado
SB2A Bermuda
SB2C Helldiver
SB2U Vindicator
SBD-3 Dauntless
SO3C Seagull
SNC Falcon
SNJ Texan
TBD Devastator
TBF Avenger
JRM-1 Mars
YO-51 Dragonfly
Sikorsky Helicopter





B-26 MARAUDERS
BOMBING INVASION COAST

★ PROVING GROUNDS

Winging through global skies in 80 types of Allied war planes . . . ploughing through the seven seas in destroyers, escort and landing craft, submarines . . . rolling through steaming jungles and over frozen wastes in tanks, trucks, jeeps, American Hammered Piston Rings prove their absolute correctness for every purpose. Koppers Company, American Hammered Piston Ring Division, Baltimore, Maryland.

American Hammered Piston Rings

A KOPPERS PRODUCT

ARMY E NAVY

The only Army-Navy "E" awarded for Piston Ring Production

Another IMPORTANT AIRCRAFT APPLICATION OF *S.S.White Flexible Shafts*

—THE GYRO FLUX GATE* COMPASS

Illustrations courtesy of Eclipse-Pioneer Division Bendix Aviation Corporation.
** "Gyro Flux Gate" is a registered trademark of Bendix Aviation Corporation.*

PARTIAL LIST OF AIRCRAFT USES OF S. S. WHITE SHAFTS

For REMOTE CONTROL
- of Radio Transmitters
- Radio Receivers
- Beacon Receivers
- Compass Loops
- Antenna Loops
- Antenna Reels
- Heating Registers
- Tab Controls
- Turn Bank Indicators
- Gyro-Pilots
- Aircraft Guns

For DRIVING
- Engine Tachometers
- Tachometer Generators
- Fuel Pumps
- Controllable Pitch Propeller Governors
- Ammunition Rounds Counters
- Windshield Wipers
- Cowl Flap Mechanisms
- Starters
- Superchargers

The revolutionary feature of this recently developed earth inductor compass is that it indicates direction with a high degree of accuracy and steadiness under all flying conditions including steep dives, fast turns and rough weather. Its accuracy under such conditions stems largely from an electrically driven gyro which maintains the sensitive earth inductor element in a horizontal position.

Important to the operation is the caging mechanism in the transmitter unit for speedily erecting the gyro at the start of flight and after maneuvers in which a certain limiting angle of pitch or bank is exceeded. This gyro caging and erecting mechanism is operated by an S. S. White remote control type flexible shaft rotated either electrically or manually. The relative locations of the control point and the transmitter unit are shown in the illustration.

S. S. White Remote Control Flexible Shafts, engineered and constructed specifically for remote control uses, have proved entirely satisfactory in this compass application, just as they have in their many other applications in aircraft.

KNOW THE RANGE AND SCOPE OF S. S. WHITE FLEXIBLE SHAFTS

These shafts are such a simple, readily adapted means of providing remote control or of transmitting power between any two points that it will pay every engineer concerned with the design of aircraft and aircraft accessories to be familiar with their range and scope. You can get this basic data by writing for Bulletin 43.

S.S.WHITE INDUSTRIAL DIVISION

THE S. S. WHITE DENTAL MFG. CO.

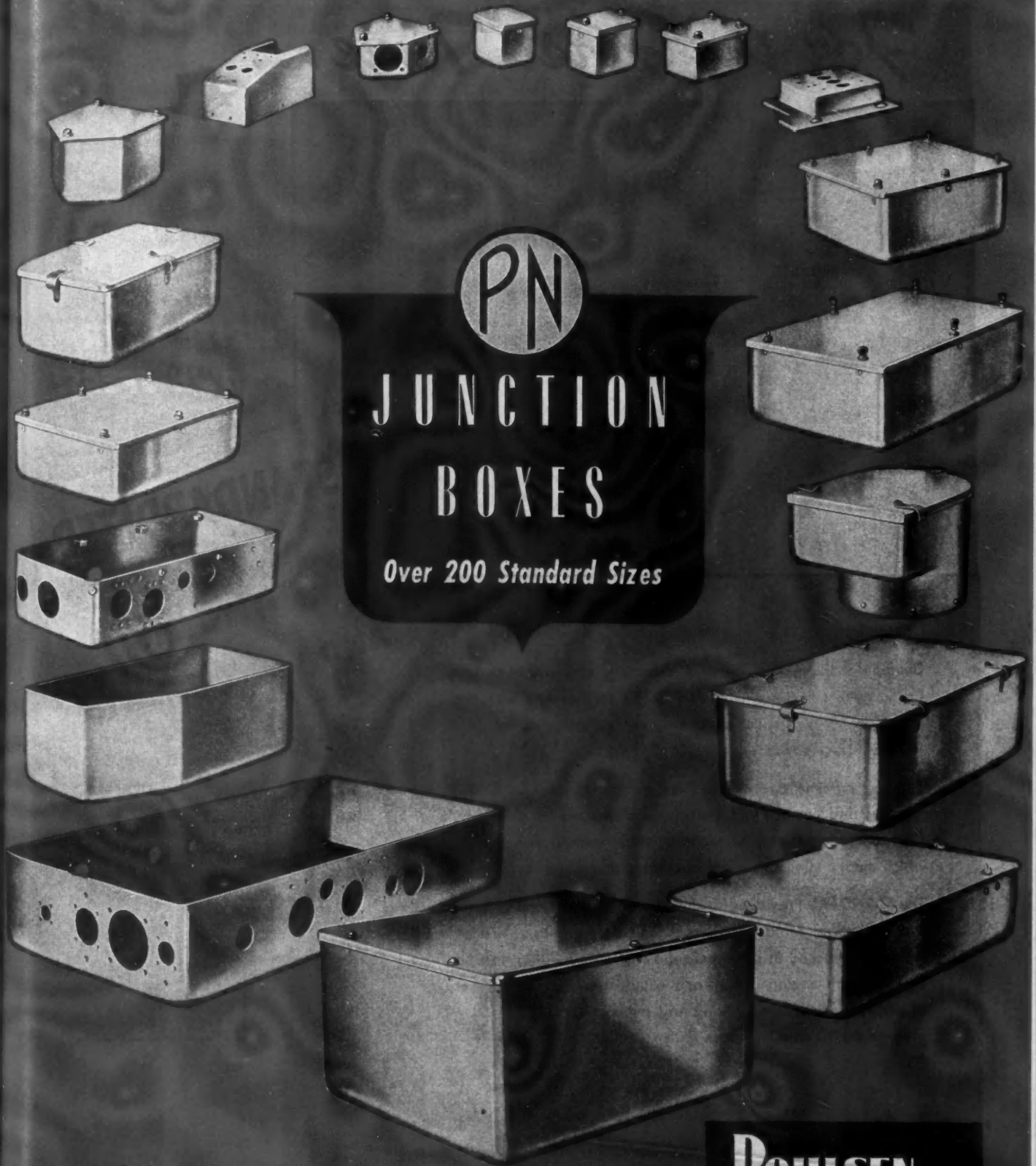
DEPT. A, 10 EAST 40th ST., NEW YORK 16, N. Y.

FLEXIBLE SHAFTS — AIRCRAFT ACCESSORIES
MOLDED PLASTICS
MOLDED RESISTORS — FLEXIBLE SHAFT TOOLS

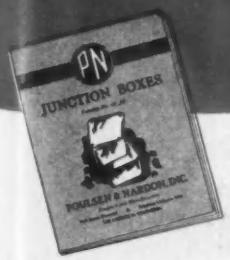
PN

JUNCTION BOXES

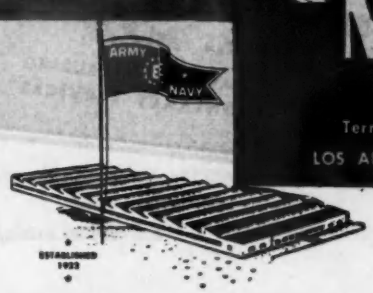
Over 200 Standard Sizes



For complete details of all P & N Junction Boxes please send for Catalog No. 43-JB.



Box sizes range from 1⅞" x 1⅞" up to 23" x 15". Material Thickness from .032" to .064" in 2S0 or 3S0 Aluminum. Covers to fit in 3S½H Aluminum. Fasteners: Boxes can be equipped with conventional nut and screw type fasteners. (Other types of fasteners on request). Delivery: 30 days or less.



POULSEN & NARDON, INC.

Terminal Box 2398

LOS ANGELES 54, CALIF.

For the First Time...

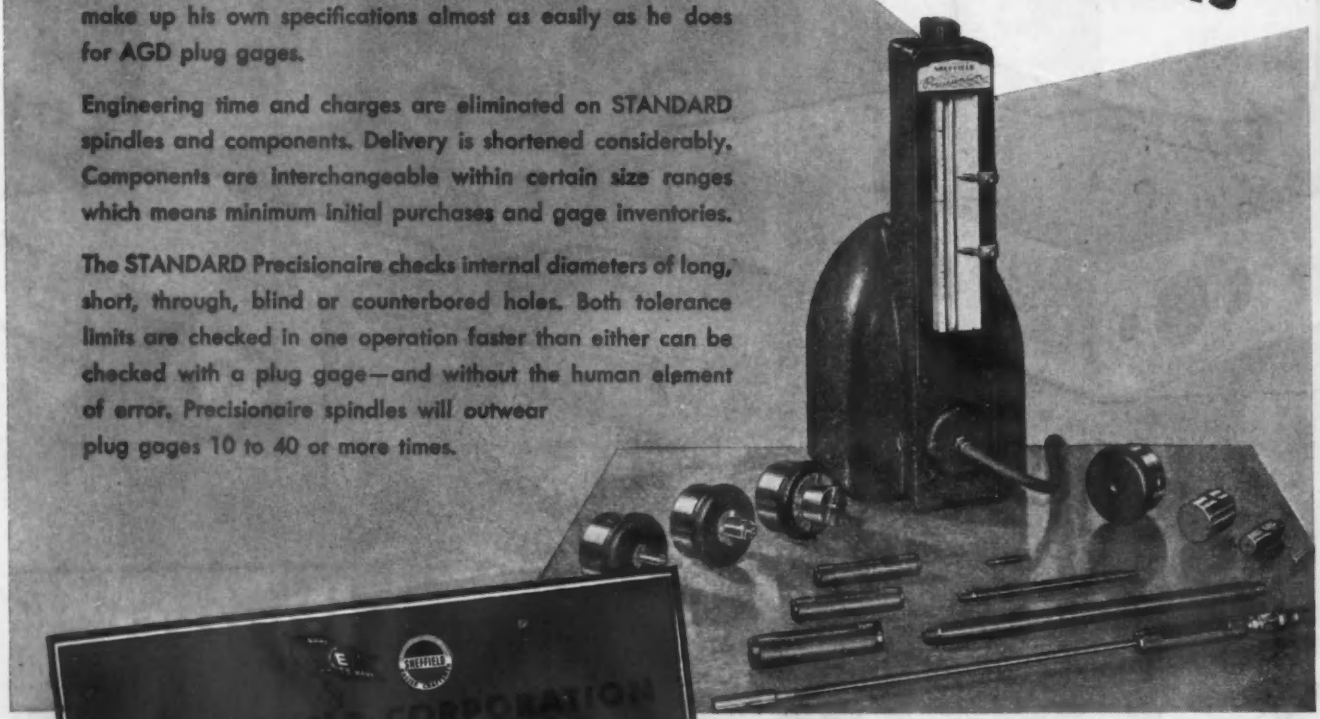
WRITE YOUR OWN SPECS!

STANDARDIZED AIR GAGE SPINDLES AND COMPONENTS

Sheffield Precisionaire spindles, adapters, etc., within certain limits, have now been STANDARDIZED so that any user can make up his own specifications almost as easily as he does for AGD plug gages.

Engineering time and charges are eliminated on STANDARD spindles and components. Delivery is shortened considerably. Components are interchangeable within certain size ranges which means minimum initial purchases and gage inventories.

The STANDARD Precisionaire checks internal diameters of long, short, through, blind or counterbored holes. Both tolerance limits are checked in one operation faster than either can be checked with a plug gage—and without the human element of error. Precisionaire spindles will outwear plug gages 10 to 40 or more times.



Write for Engineering Data No. 12 on Sheffield STANDARDIZED Precisionaire Components and SPECIAL applications.

STRIKING POWER

More than 50,000 Allison engines have been built for the use of Allied fighting pilots around the globe. ★ These skilled pilots using fighting planes powered by these engines have established a lopsided "box score" in our favor. ★ That is testimony to the striking power of good men armed with good American fighting equipment. ★ It is also an indication of aircraft engine performance you will be glad to have in the planes you use after final victory.

POWERED BY ALLISON

P-38—Lightning
P-39—Airacobra
P-40—Warhawk
A-36 and P-51—Mustang

The more-than-50,000 Allison engines built for the U. S. Army Air Forces power the above planes.

LIQUID-COOLED AIRCRAFT ENGINES

KEEP AMERICA STRONG
BUY MORE WAR BONDS

Allison
DIVISION OF
Indianapolis, Indiana

GM
GENERAL MOTORS

Every Sunday Afternoon—GENERAL MOTORS SYMPHONY OF THE AIR—*NBC Network*

...who is wondering what he'll be up against when Postwar Markets and Production open up!...

Maybe the first flood of postwar buying will gobble up anything and everything that's available, just so long as it satisfies the immediate and pressing need.

But, that won't last forever. Pretty soon the public will be its old critical self again, looking thoughtfully at quality, looking hard at the price tag, shopping around for the big buy.

Now—one of the good things that has come out of this war is the widespread recognition of the special-purpose machine's ability to boost production and quality and cut costs. This ability was well known to many before the war. Now, it is known to many others whose prewar line-up of standard machines couldn't cope with war-time production demands and who found in special-purpose machines the logical —and the only—answer.

How far will those organizations go (perhaps yours among them) in applying war-time experience to postwar production? Will the old prewar machines go back in the line? Or, will their place be filled by special-purpose equipment in which a series of operations are performed automatically in a fraction of the former time—tolerances accurately held—specified finish maintained—costs lowered substantially?

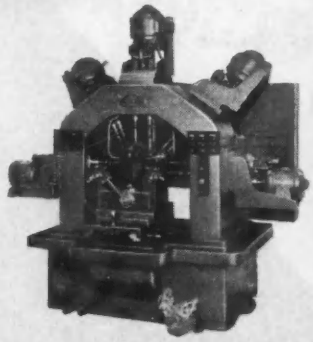
Such achievements have been common in war production. They can be just as common in postwar production. They MUST be, if we are going to have volume markets—and the prosperity that goes with them.

But, they won't happen automatically. Somebody must DO something about them to MAKE them happen. One good way is to call in Snyder and get the benefit of 20 years experience in solving production and cost problems.

And, of course, the time to do this is NOW. Machines can be designed now, built when present restrictions are lifted and installed, ready to produce as soon as materials are available. *Snyder Tool & Engineering Company, 3400 E. Lafayette Ave., Detroit 7, Michigan.*

SNYDER

DESIGNERS AND BUILDERS OF SPECIAL-PURPOSE MACHINES FOR HIGH PRODUCTION AT LOW UNIT COST



SNYDER KNOWS HOW

This special-purpose, automatic cycle machine, designed and built by Snyder for multiple direction tapping in aircraft cylinder heads, is made with varying numbers of taping units and various combinations of single and multiple spindle heads.

With fixture table in forward position for loading, safety limit switch is automatically held open. Rolling table into working position and accurately locating with index pin closes switch. Tapping units consist of two parts—motor mounting bracket, first reduction gear unit, limit switches and controls. This part is uniform on all machines. Head on any tapping unit may carry one, two, three or four lead screw spindles.

Lead screw spindles are hardened and ground sleeves operating in Ampco bronze bushings, adjustable for wear. Each tapping head is equipped with individual set-up control button which is inoperative when machine is on automatic cycle.

PLAN Your PRODUCTION when you PLAN Your PRODUCT

20 Years of Successful Co-operation with Leading American Industries

FOR PRODUCTION—TOOL ROOM—MAINTENANCE

..A Simple low-cost answer to metal sawing problems

WELLS No. 8
Capacity
8" x 16" RECTANGLE
8" DIAMETER, ROUND

SAVE TIME AND LABOR by placing a Wells Saw wherever you have metal to cut—production line, tool room, repair shop or other departments. The Wells is such a low cost, versatile saw, there is no need to tie-up large special production units on odd jobs—or to waste time and labor transporting metal to a saw (the Wells is easy to move to the job).

Why not see your supply man for complete details and a demonstration—it will be worthwhile.

Wells SAWS
THE SIGN OF SERVICE

Wells

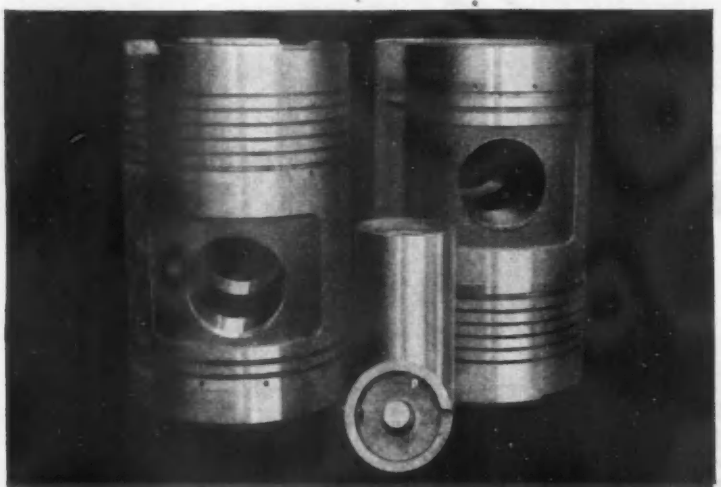
Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
101 JEFFERSON ST., THREE RIVERS, MICHIGAN

PISTON PRODUCTION INCREASED 125%

AT DIESEL ENGINE PLANT



Diesel pistons before and after boring operations. (See tooling —operations below.)

W. F. and John Barnes Duplex Piston Boring Machine.

TOOLING AND OPERATIONS

1st OPERATION—Rough bore 2 diameters from both sides (diameters 4.985" and 5.113").

2nd OPERATION—Finish bore 2 diameters from both sides (diameters 5.000" +.001" and 5.128 ±.001". −.000"

TOOLING—Special sleeve or shell type boring tools with two diametrically opposed carbide tools for each diameter.

WORK MATERIAL—Aluminum alloy casting (#302 ALW).

CUTTING MATERIAL—Carboloy #44-A.

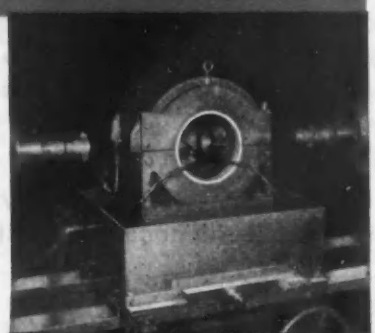
COOLANT—Kerosene.

SPINDLE SPEED—194 R.P.M.

FEED—.006".

WORKING STROKE—4½".

TOTAL STROKE—28".



Special sleeve or shell type boring tools are used. Work piece held in saddle type fixture.

2 HOLES ROUGH AND FINISH BORED AND COUNTERBORED WITH W. F. AND JOHN BARNES MACHINE

Boring time was reduced by more than one-half when this large W. F. and John Barnes duplex boring machine was put into production at a locomotive plant manufacturing 6 - cylinder diesel engines. The previous method required 45 minutes per piece. Floor-to-floor time is now only *20 minutes,* of which 15 minutes are consumed in loading, unloading and tool changing.

To bore and counterbore the two piston pin holes simultaneously, the machine has two opposing spindles and is made with two sliding head self-contained hydraulic units. Each diameter is bored by two diametrically opposed carbide tools. Special sleeve or shell type boring tools are used, fitting the arbors in the work spindles and locked by collar and screw. The workpiece is held in a saddle-type fixture.

SEND US YOUR PRODUCTION PROBLEMS

At no obligation, our engineers will analyze your requirements and suggest a machine to fill them. W. F. and John Barnes have solved machining problems for makers of products ranging from pencil sharpeners to artillery gun barrels and locomotive parts. Our equipment is large enough to machine long, heavy beds and other large machine parts — our assembly capacity can handle any machine, regardless of size. Let us make specific recommendations for your latest problem, large or small.

These useful booklets show how W. F. and John Barnes machines are designed to meet specific requirements. Boring, drilling, reaming, tapping and milling operations can be done simultaneously. Each booklet may suggest a tooling or production set-up you can use today. Write now — ask for Bulletin 744B

W. F. & JOHN BARNES

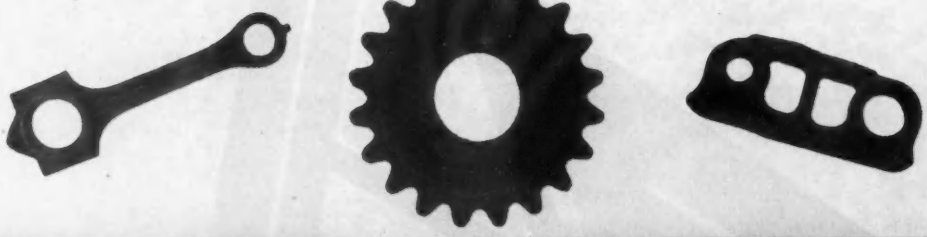
W. F. and JOHN BARNES

312 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

Doing an important job

TODAY . . . . TOMORROW

Tractor forgings produced by Ladish are helping clear airfields for fighting planes on every battle front . . . helping the home front to produce more to gain a quicker Victory . . . and a more lasting Peace.



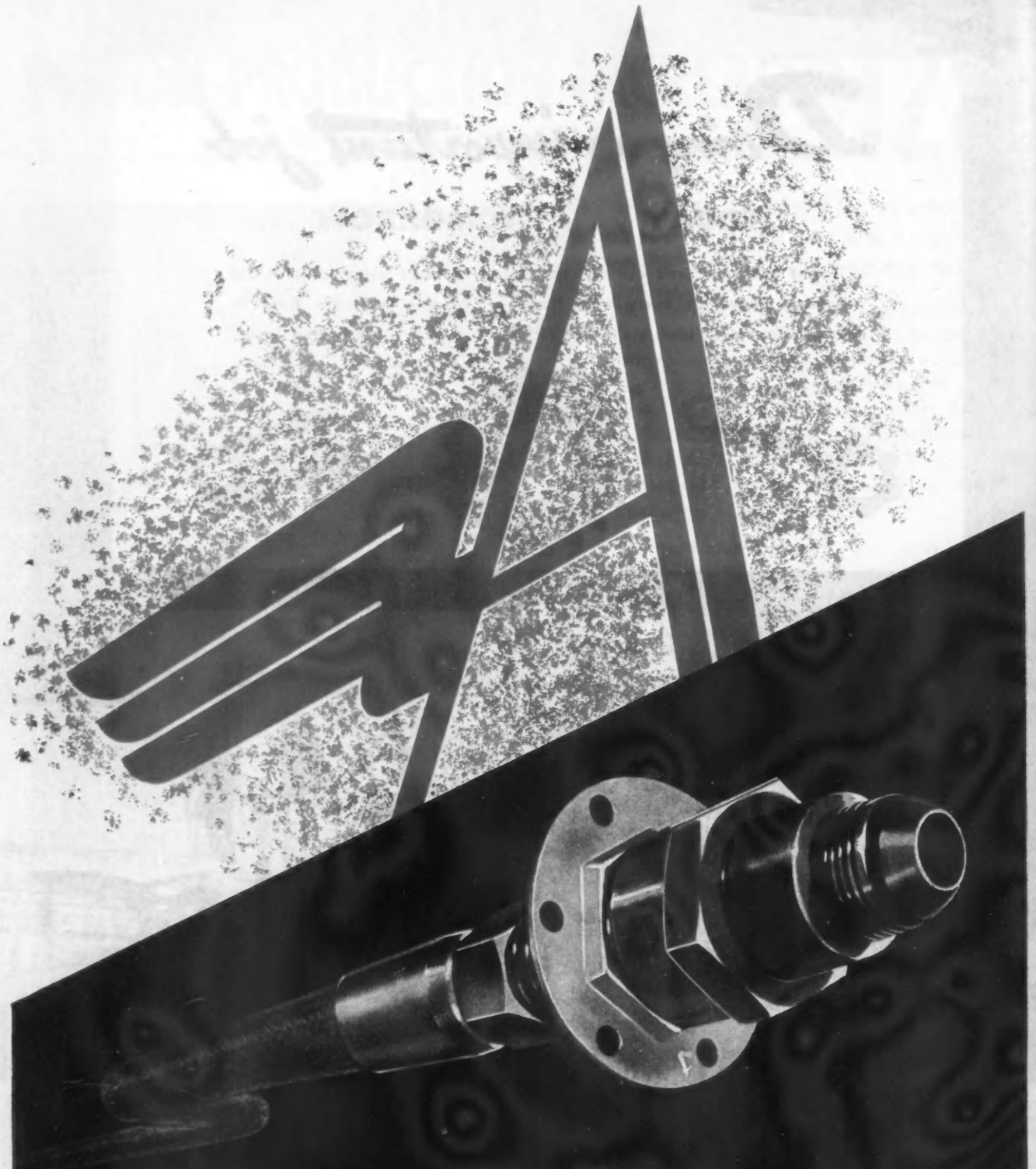
TO MARK PROGRESS

ARMY E NAVY

LADISH DROP FORGE CO.

CUDAHY • WISCONSIN

MILWAUKEE SUBURB



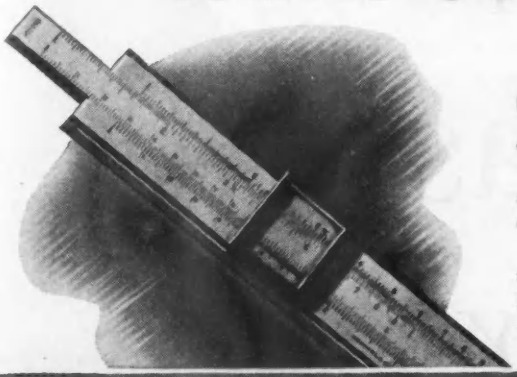
AEROQUIP HOSE LINES AND COUPLINGS ARE STANDARD ON ALL ARMY AND NAVY AIRCRAFT. HOSE LINES WITH DETACHABLE, RE-USABLE FITTINGS ARE QUICKLY SERVICEABLE IN THE FIELD . . . COUPLINGS CAN BE DISCONNECTED AND RE-CONNECTED WITHOUT LOSS OF FLUID OR ADMISSION OF AIR.

AEROQUIP CORPORATION

JACKSON, MICHIGAN, U. S. A.

303 WAREHAM BLDG., HAGERSTOWN, MD. - 1709 W. 8th., LOS ANGELES - PRENCO—72 STAFFORD ST., TORONTO, ONT.
PERMANENT LICENSEE: WAGNER ELECTRIC CORPORATION, 6400 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

WEAPONS OF PEACE!

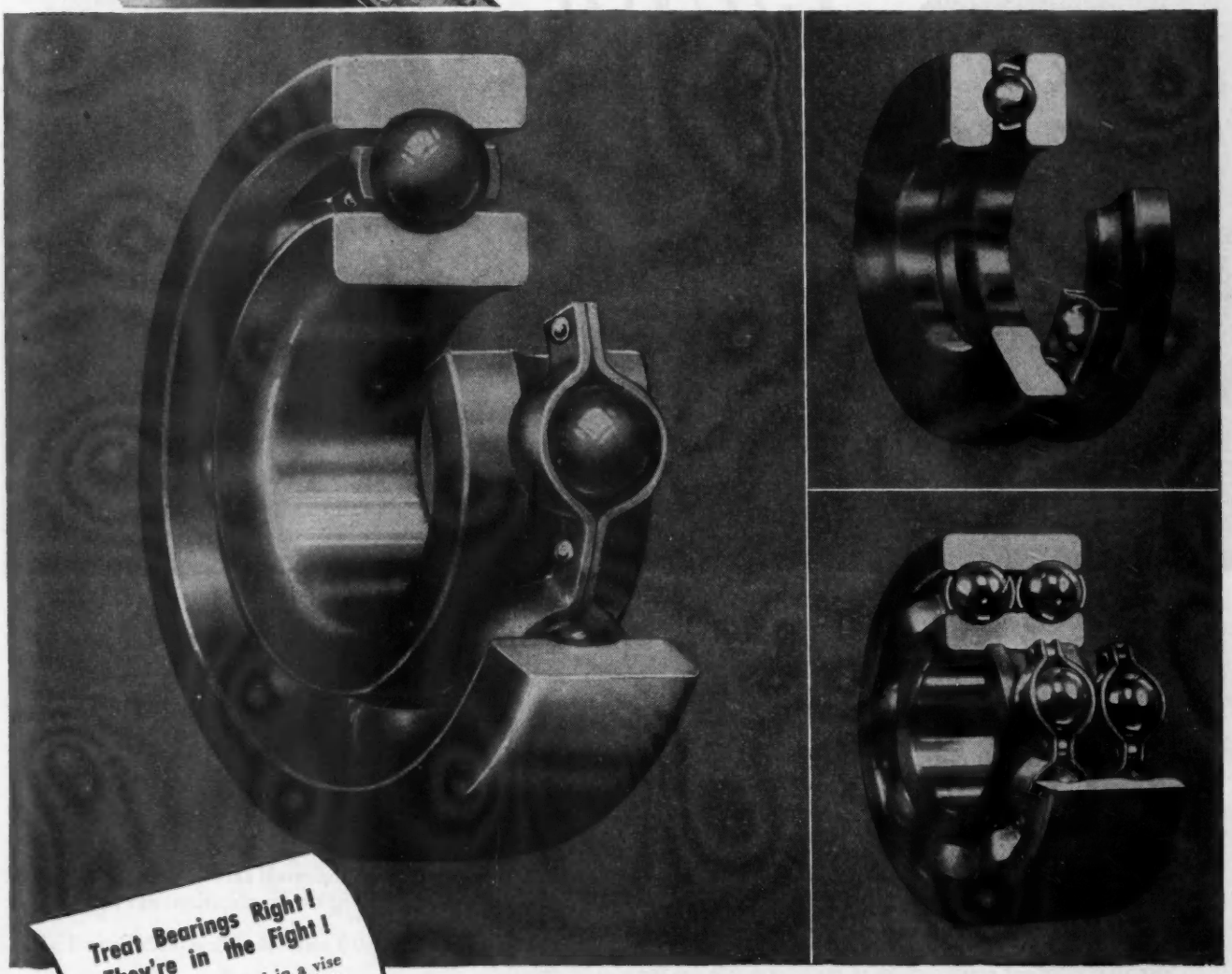


ORDNANCE OFFICERS will tell you that ball bearings are weapons of war. Cut off a nation's supply of ball bearings, they'll say, and you deprive it of military mobility.

BCA Ball Bearings will also be weapons of *peace*... weapons of the designers and engineers who will spearhead the fight for wider acceptance of American machines... tools... cars... trucks... tractors.

The time to consider how BCA Ball Bearings may help *you* in that fight is *now*. Plan your use of BCA's *before* the reconversion. It's one step that will help you avoid the risks of production and sales lag.

BEARINGS COMPANY OF AMERICA, LANCASTER, PENNA.



Treat Bearings Right! They're in the Fight!

1. If shaft is placed in a vise when mounting bearings, protect the shaft with soft metal, wood, cardboard or paper.
2. Be sure housing covers are tight. They are designed to keep lubricant in... keep dirt out. They can't do either if they're loose.
3. Store bearings in a dry place.

BCA

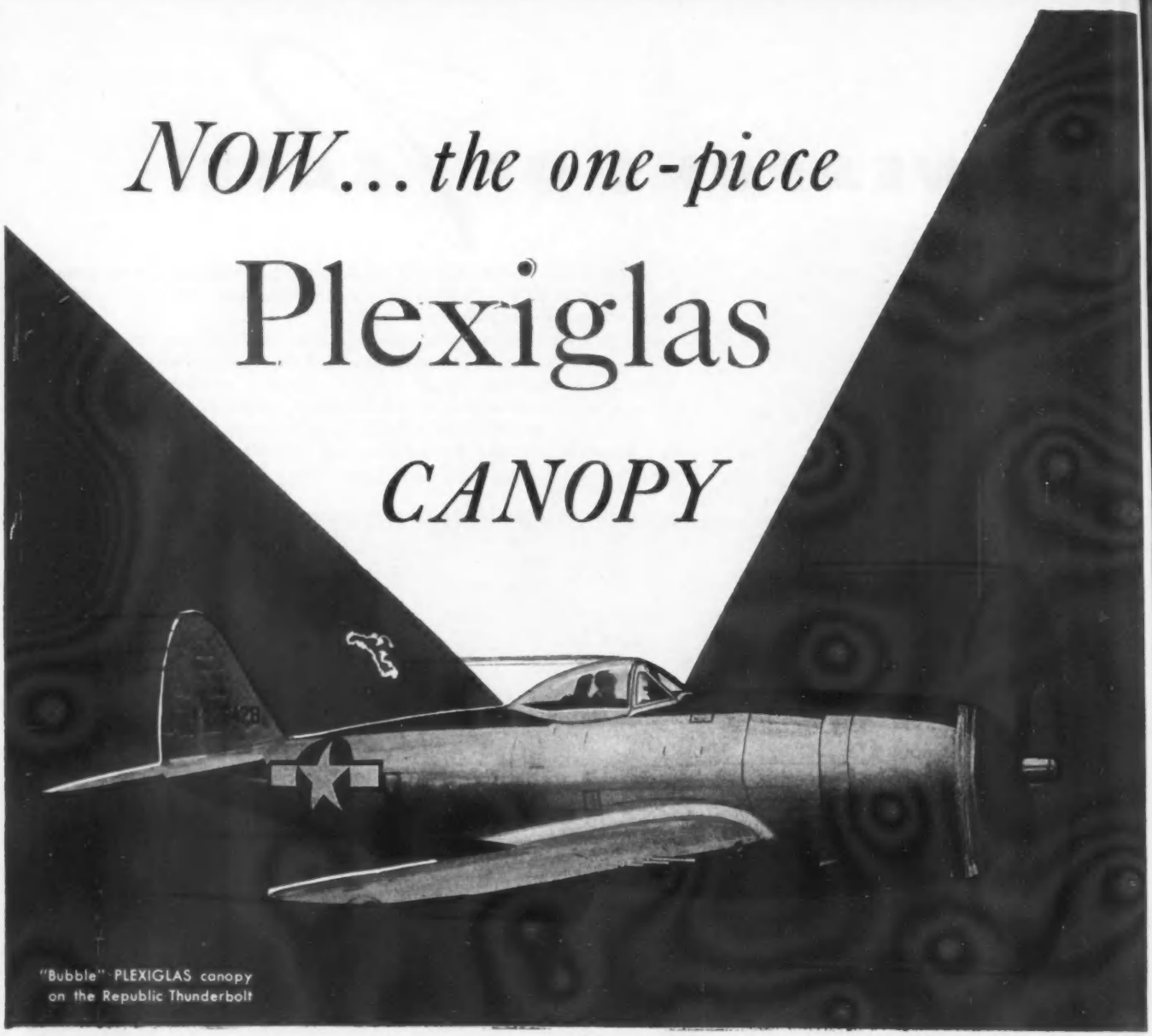
RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

NOW... the one-piece

Plexiglas

CANOPY



"Bubble" PLEXIGLAS canopy on the Republic Thunderbolt

ON America's fastest fighters, a new type of PLEXIGLAS canopy is saving pounds . . . simplifying installation procedure . . . affording a wider field of unobstructed vision for the pilot.

Developed by Rohm & Haas in close cooperation with the Army Air Forces, and the leading aircraft companies, the "bubble" canopy is a single section, requiring no supporting framework of any kind.

Perhaps the most striking feature of the "bubble" canopy is the way in which it utilizes, to *new* advantage, the long-familiar characteristics of PLEXIGLAS.

The unreinforced construction is made possible by the *high strength* of this Rohm & Haas acrylic plastic.

The elimination of the metal supports used in earlier designs increases still further the weight savings resulting from the *lightness* of PLEXIGLAS itself.

Removing all obstructions from the pilot's range of vision, the canopy gives full scope to the plastic's *permanent transparency*.

This latest application of PLEXIGLAS may suggest to you new ways in which you can utilize the advantages of this material in your own current production or post-war designs. The Rohm & Haas technical service staff is ready to work with you in developing new applications of PLEXIGLAS.

DETROIT OFFICE: 619 Fisher Building—Madison 1500

***Only Rohm & Haas makes* PLEXIGLAS**

PLEXIGLAS is the trade-mark, Reg. U. S. Pat. Office, for the acrylic resin thermoplastic sheets and molding powders manufactured by Rohm & Haas Company.

ROHM & HAAS COMPANY

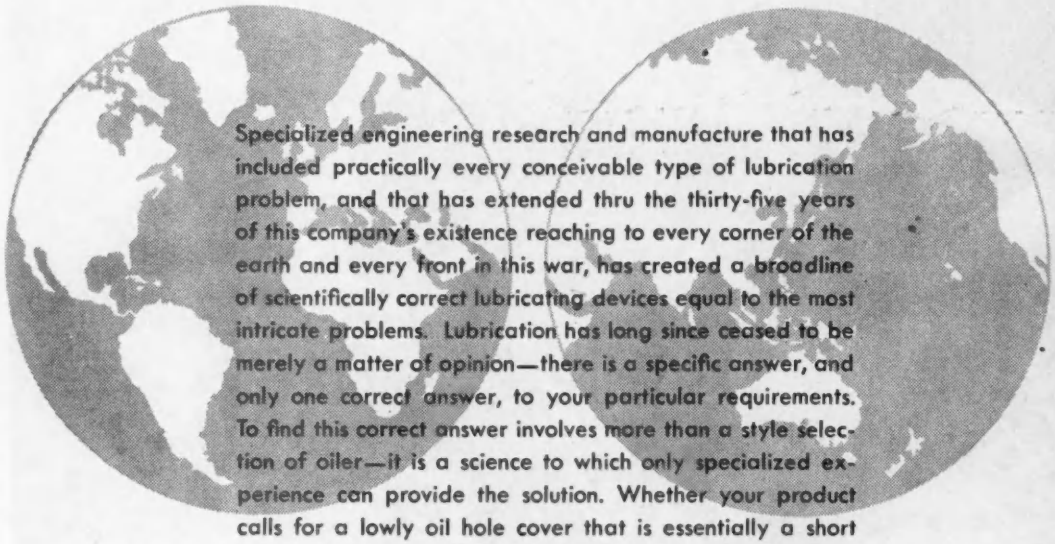
WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

35 YEARS OF EXCLUSIVE LUBRICATION ENGINEERING

GITS

TRADE MARK REG. U. S. PAT. OFF.



Specialized engineering research and manufacture that has included practically every conceivable type of lubrication problem, and that has extended thru the thirty-five years of this company's existence reaching to every corner of the earth and every front in this war, has created a broadline of scientifically correct lubricating devices equal to the most intricate problems. Lubrication has long since ceased to be merely a matter of opinion—there is a specific answer, and only one correct answer, to your particular requirements. To find this correct answer involves more than a style selection of oiler—it is a science to which only specialized experience can provide the solution. Whether your product calls for a lowly oil hole cover that is essentially a short length of tubing with a hinged cover, or a more intricate device that is required to automatically lubricate many points from a central reservoir with a measured quantity of oil at given time intervals—you will practice true economy and insure maximum efficiency and service by employing the experience of Gits Engineers—the kind of experience that has been acquired the hard way. When you are faced with a lubricating problem—consult Gits.

GITS BROS. MFG. CO.

1869 South Kilbourn Ave., Chicago 23, Ill.

Request Catalog No. 60 with 172 pages of lubricating devices and engineering data.

Threaded Oilers

Tube Oilers

Unbreakable Transparent Oilers

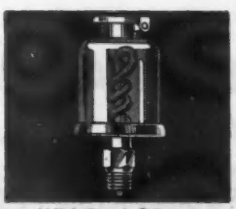
Constant Level Oilers

Ball Valve Oilers

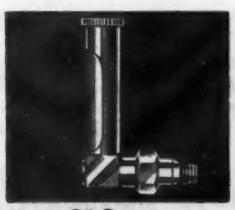
Sight Gravity Feed Oilers

Screw Cap Oilers

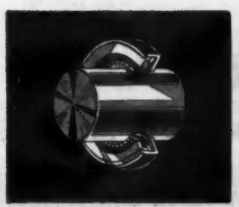
Elbow Oilers



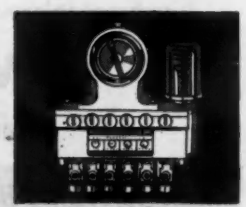
Wick Feed Oilers



Oil Gauges

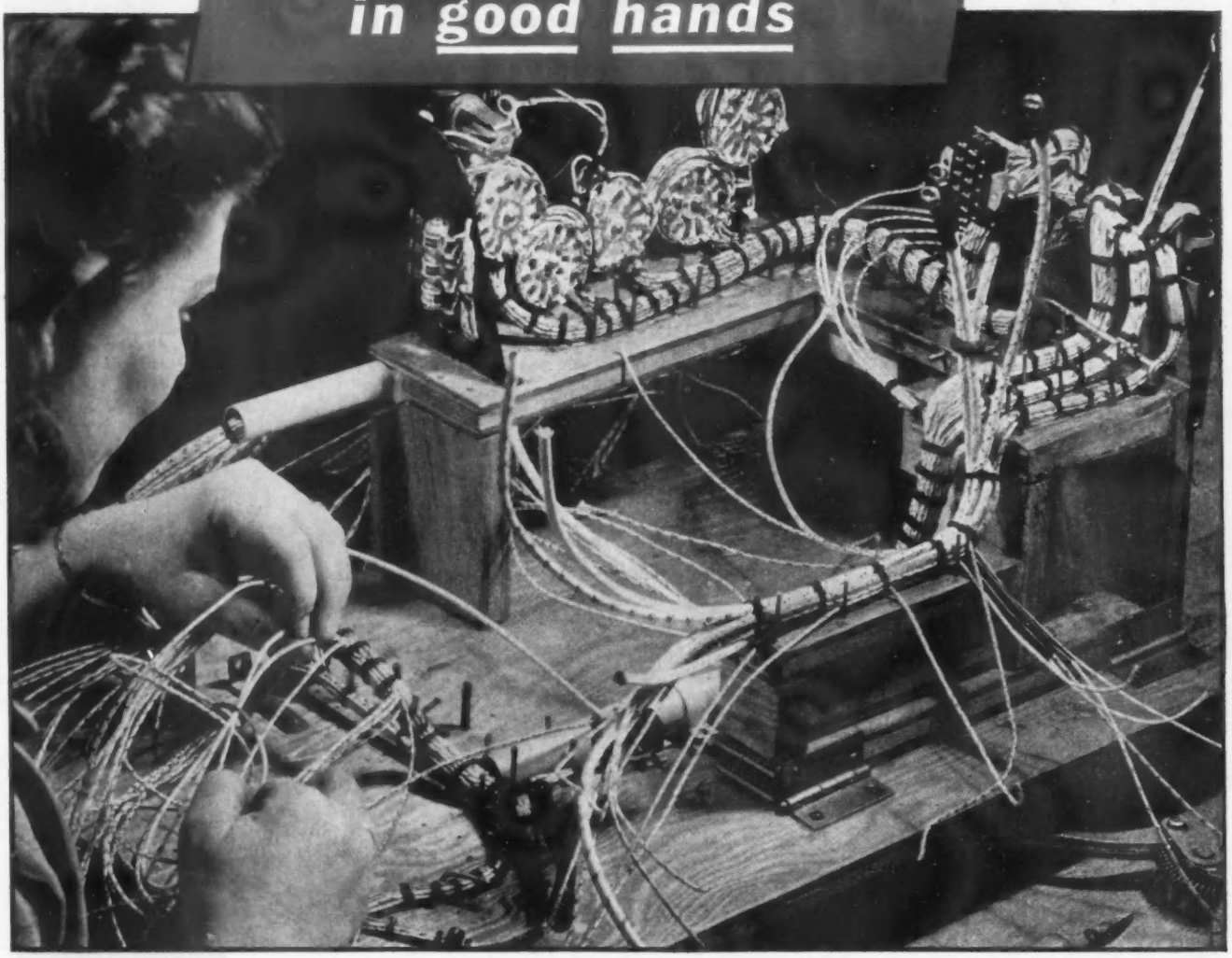


Oil and Grease Seals



Multiple Oilers

PUT YOUR WIRING ASSEMBLY REQUIREMENTS in good hands



No Wiring Harness Is Too Complicated For Us To Produce

If your production needs include wiring harnesses, bonding jumpers, or cable assemblies — you have everything to gain by getting in touch with Whitaker... Backed by a quarter of a century of experience in cables for automotive, electrical, radio, marine, and aviation applications, our organization is well qualified to turn out work quickly . . . accurately . . . satisfactory . . . in volume — to your specifications . . . Whitaker has the "know-how", skilled manpower, and ample plant facilities for a big volume of wartime and post-war production.

We solicit your inquiries, and invite you to mail us wiring diagrams or blueprints of your units.

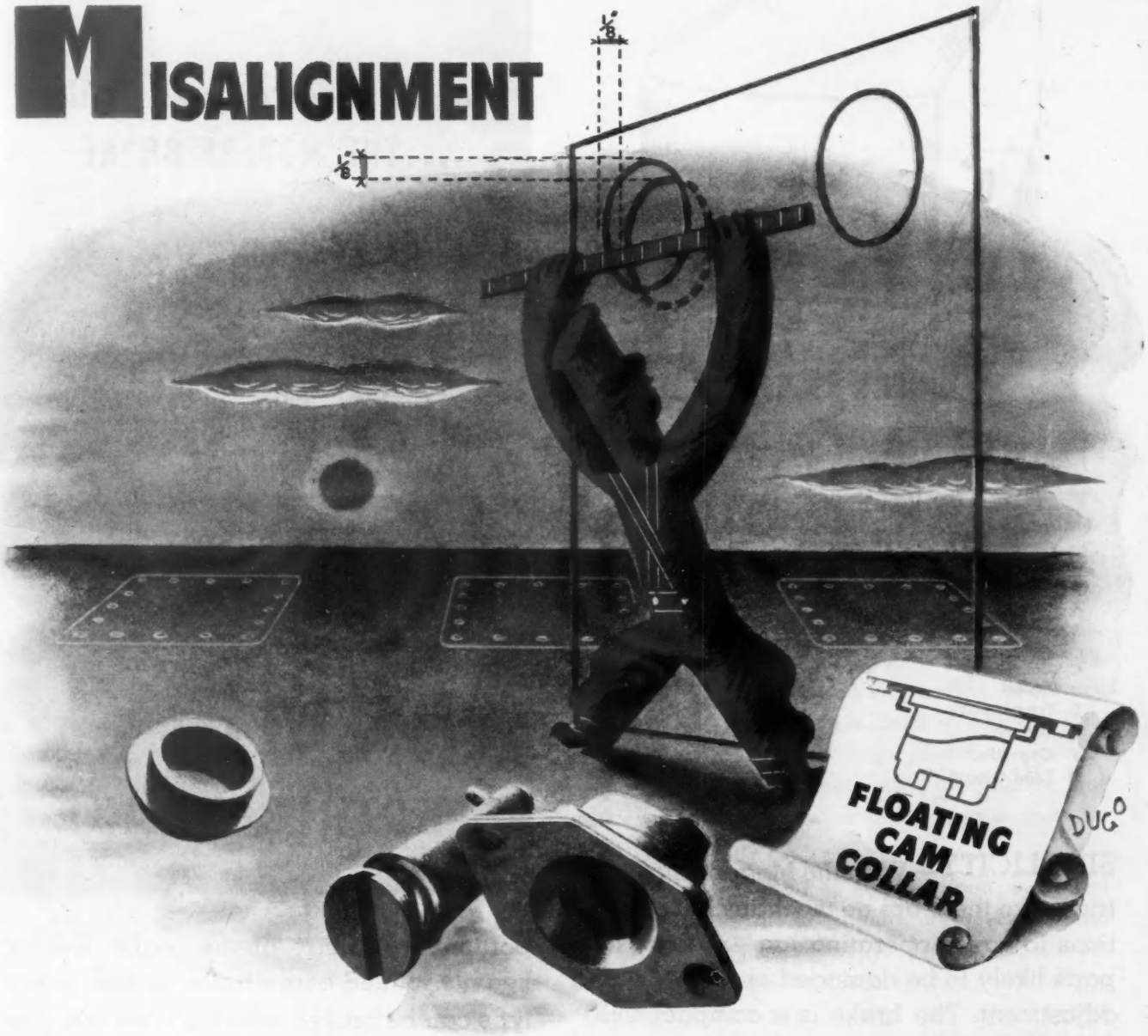
WHITAKER CABLE CORPORATION

(Formerly Whitaker Battery Supply Company)

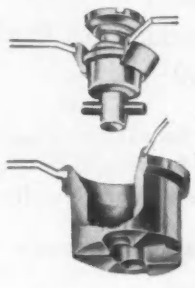
Kansas City, Mo. · St. Joseph, Mo. · Philadelphia · Oakland

Cables, Wiring Harnesses and Assemblies for Automotive, Aircraft, Marine and Radio Equipment

MISALIGNMENT



The many makers of fighting aircraft who have adopted Camloc High Speed Fasteners find misalignment no handicap to production speed. Camloc's solution is the Floating Cam Collar. Made to take all Camloc Stud Assemblies, it is freely self-centering, allowing for misalignment up to ⅛" *in any direction*. Stud grips Cam Collar uniformly thus preventing eccentric loading and sheet warpage. Camloc Fasteners which are so successfully meeting the precision requirements of war, will one day be available for speed fastening in many products of metal, plastic and plywood. Write for catalog.

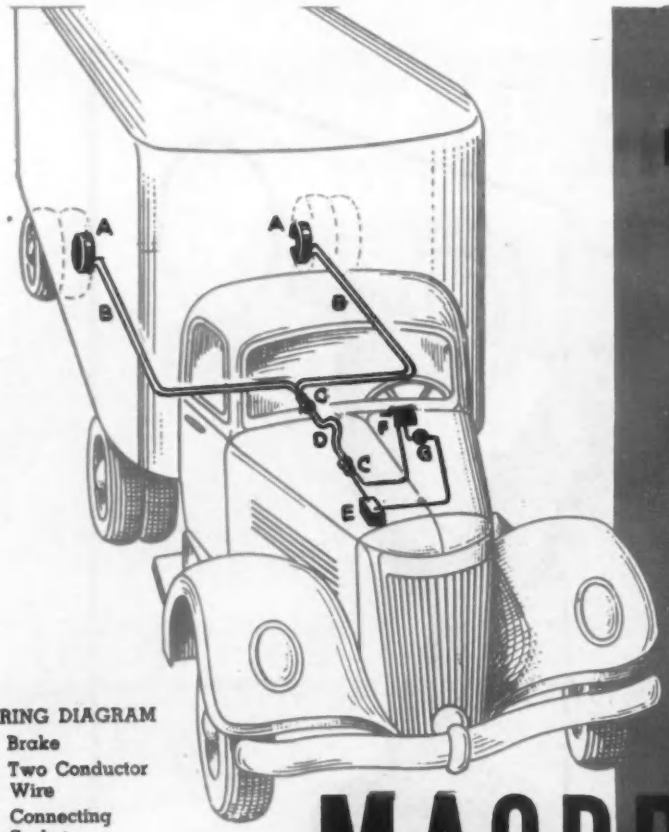


Camloc Fasteners are comprised of three units — Stud Assembly, Grommet and Cam Collar. A selection of Cam Collars includes designs for mounting through a single hole or with rivets. Easier to install, easier to operate, easier to service.

CAMLOC *high-speed* FASTENERS

Copr. 1944 Camloc Fastener Corporation

CAMLOC FASTENER CORPORATION, 420 Lexington Ave., New York 17—5410 Wilshire Blvd., Los Angeles 36



WIRING DIAGRAM
A Brake
B Two Conductor Wire
C Connecting Socket
D Jumper Cable
E Battery
F Controller
G Load Control

For the Modern Cargo Trailer
...THE MODERN BRAKE

MAGDRAULIC
ELECTRIC BRAKE

SIMPLICITY—With the Magdraulic Electric Brake there are no mechanical connections to cause operating lag—no exposed parts likely to be damaged or to get out of adjustment. The brake is a compact, self-contained unit, and for its operation requires only a wire from the controller to each wheel. This leaves the full clearance under the vehicle on which the brake is used.

POWER—The unique application of an electro-magnet on the end of a lever develops an enormous braking torque in proportion to the size of the brake. Even a heavily loaded cargo trailer of the largest type can be braked with the ease of a passenger car.

OPERATION—Because it is electrically operated, the action of the Magdraulic Brake is instantaneous and the braking effect is always smooth.

Supplied at present for essential war work, the Magdraulic Electric Brake will be available for all types of automotive vehicles after the war.

DESCRIPTIVE BULLETIN WILL BE FURNISHED ON REQUEST

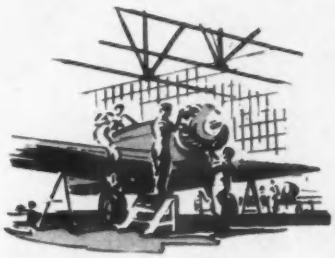
ELECTRIC EMPIRE BRAKE CO.

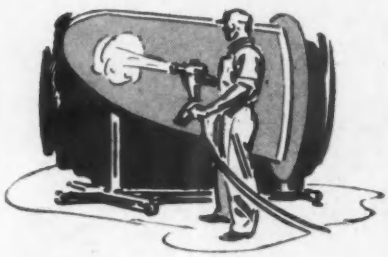
South 14th Street — Newark 7, New Jersey

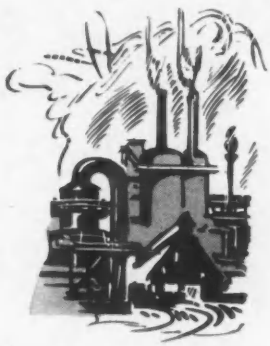
Manufacturers of **MAGDRAULIC ELECTRIC BRAKE • VACDRAULIC BRAKE POWER BOOSTER AND EMPIRE STEERING BOOSTER AND STABILIZER**

13

A name worth remembering







● We're not too old as rubber companies go—but our eighteen years of operation have proved to a lot of top-flight manufacturers that industrial rubber products from Rodic are unbeatable in quality.

The reasons for Rodic quality are the standard American reasons, the same reasons why American fighting men are the world's best equipped: crackerjack chemists and outstanding laboratory technicians . . . skilled design engineers, experts in rubbers, synthetics and plastics . . . production facilities geared to produce fast and in volume . . . and management with imagination and foresight, dedicated to the proposition that progress must be planned for, then worked for.

We're up to the hilt in war work, of course. Rodic industrial rubber goods are serving in aircraft engines and airframes and tanks and many other places where rubber is helping to win the war. Come the day of Victory, the things we can make will go into homes and refrigerators and automobiles, into business machines and electric ranges, into motors and truck bodies and the transport aircraft of peace.

A company is known by the customers it keeps. We're serving some of the best, today. Tomorrow we'll be knocking on *your* door, with irresistible ideas on how our kind of extruded shapes, or bonded goods, or molded products, or hose, or lathe-cut items, can make your postwar product better to produce and easier to sell.

For *Sealing Unlimited . . .*

SEALING *In*
GAS, OIL, HYDRAULIC FLUID

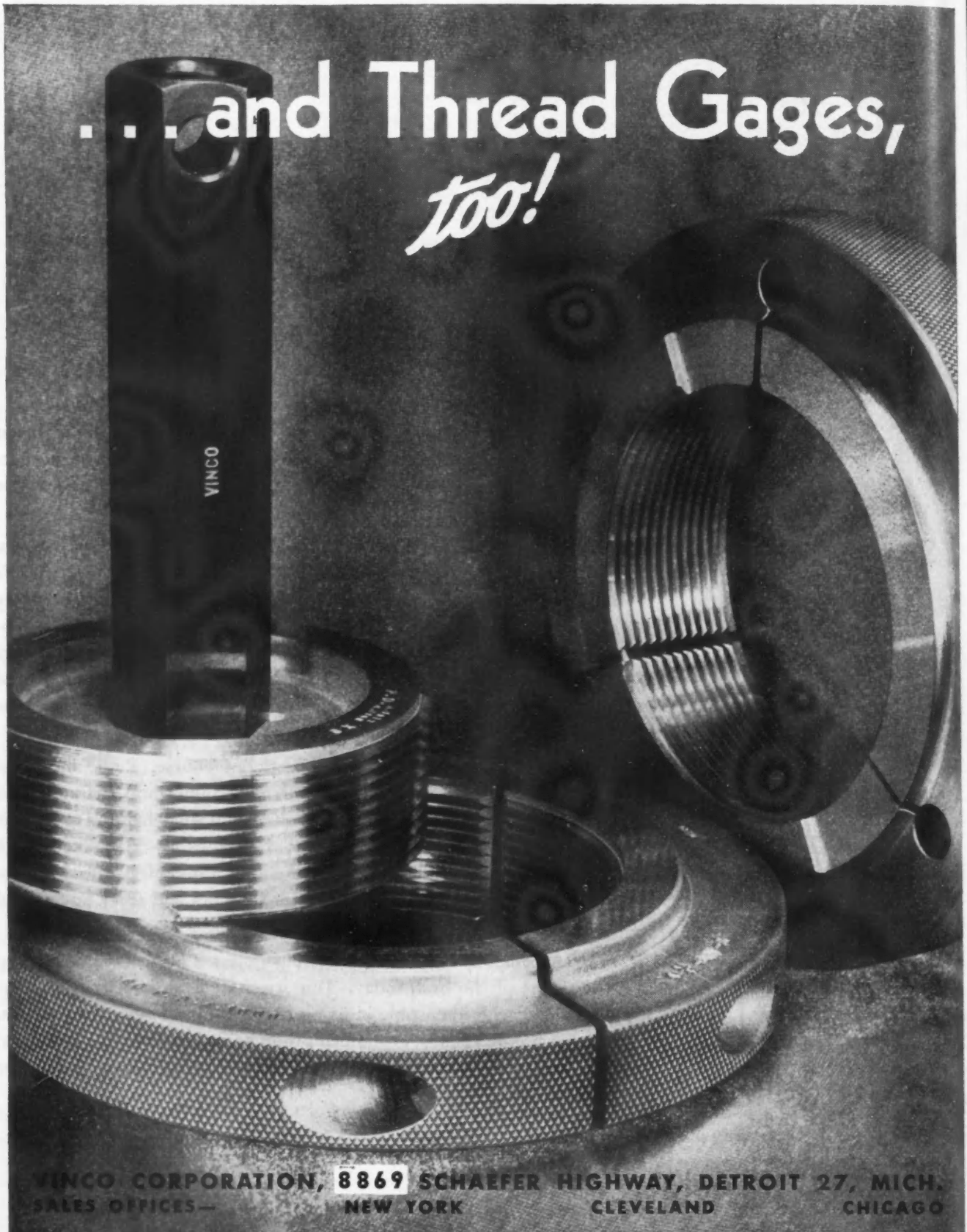
●

SEALING *Out*
DIRT, MOISTURE, AIR

●

SEALING *Against*
VIBRATION OR SHOCK

RODIC RUBBER
CORPORATION, Garwood, N. J.



VINCO CORPORATION, 8869 SCHAEFER HIGHWAY, DETROIT 27, MICH.
SALES OFFICES— NEW YORK CLEVELAND CHICAGO

MILLIONTHS OF AN INCH FOR SALE BY VINCO

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development.

PRESSTITE *Extruded Seam Sealing Tape Seals Fuselage Joints of Lockheed's Giant "Constellation"*

Built to fly faster, farther, and with bigger loads than any other land transport now in production, Lockheed's giant 4-engined 8,800 horsepower craft recently broke the transcontinental record from Burbank to Washington. The fuselage seams of this great carrier are safely sealed against weather and pressure with Presstite Extruded Seam Sealing Tape.

Thus another famous American airplane joins the ranks that include the "Flying Fortresses," "Commandos" and many others in which Presstite Sealing Compounds are used.

Your own sealing problems may not be as complex as those in the aircraft field where extremes in temperatures and pressures, plus constant strains and flexings, are encountered. But it is Presstite's wide experience in developing sealers for industry that has made such wartime achievements possible.

Presstite's engineers are *sealing specialists*—continually developing sealing compounds to meet specific requirements of industry and the Armed Forces. We'll gladly work with you, too, on your present and postwar sealing problems.

A Partial List of Industries for Which Presstite has Successfully Developed Special Sealing Compounds:

For the Aircraft Industry:
Sealers for—
Integral Fuel Tanks
Fuselage Seams
Drop-off, Expendable Fuel Tanks
Gun Turrets
Synthetic Glass
Instruments
Intercoolers
Air Ducts
Insulating Dissimilar Metals
Seaplane Floats

For the Refrigeration Industry:
Sealers for Domestic and Commercial Refrigerators
Bonding and Sealing Low Temperature Insulation in Refrigerated Rooms

For the Railroads:
Sealers for Insulating, Soundproofing and Weatherproofing of Railway Cars—Sealing Car Windows and Spot Welded Seams

For the Building Industry:
Roof Coatings, Caulking, and Waterproofing Compounds

For the Shipbuilding Industry:
Insulation Adhesive and Sealers—Rust Preventive Compounds

For the Automotive Industry:
Special Adhesives and Sealers

For the Construction Industry:
Sealers for Jointing Sewer Pipes
Sealers for Waterproofing Excavation Work

Miscellaneous:
For Glazing Greenhouse Windows
Extruded Caulking Compounds
Ammunition Paints
Plus Many Special Products for the Army and Navy

Our Engineering, Technical, and Laboratory facilities are at the service of any industry with a sealing problem.

PRESSTITE SEALING COMPOUNDS

PRESSTITE ENGINEERING CO.
3926 Chouteau Ave., St. Louis 10, Missouri
Sales Offices: Los Angeles 21, Calif., 2145 Bay St.; Detroit 2, Mich., 6432 Cass Ave.

War Demonstrates the VALUE of

Danly National Assembly saves thousands of hours daily in die set delivery—hours that mean war production.

Seven branch assembly plants are stocked with the basic precision parts, ready to assemble Danly Standard Die Sets to your specifications for immediate shipment.

Now, with branch stocks restored, Danly National Assembly assures you faster delivery, smoother press operation, longer life for your dies, lower production costs.

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue • Chicago 50, Illinois

CHICAGO
2100 So. 52nd Ave... *Lawndale 7440*

DETROIT
1549 Temple Avenue.. *Cherry 6666*

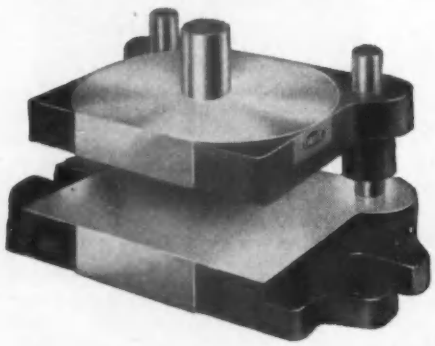
CLEVELAND
1550 East 33rd Street.. *Express 0300*

DAYTON
990 East Monument... *Fulton 6651*

ROCHESTER
16 Commercial Street.. *Main 2554*

LONG ISLAND CITY
47-28 37th Street.. *Ironsides 6-8080*

DUCOMMUN METALS & SUPPLY CO.
Los Angeles..... *Kimball 0181*
4890 South Alameda Street



DANLY DIE SETS

ARMY E NAVY

DIE MAKERS SUPPLIES • *Welded Steel Fabrication*

From the Crucible of War

. . . a new world of transportation

History's greatest test of men and metals —today's global war—brings striking evidence of the versatility of N-A-X alloy steels. From the brittle cold of the Arctic Circle to the steaming heat of the jungle, in practically every type of war equipment, N-A-X HIGH TENSILE and N-A-X 9100 SERIES STEELS have met the worst that weapons, wear and weather could hand out—and they've come out consistent winners!

N-A-X alloy steels made by Great Lakes Steel Corporation have solved many a war production problem and added impetus to our victory program. First, the fighting toughness of these metals has enabled manufacturers to use them in many products which formerly required more critical materials. Second, their fabricating efficiency has speeded up arms production. And finally, the sheer tonnage of their output has helped to snow the Axis under with an overwhelming weight of Allied equipment.

Today the vast requirements of our country's war production program take all the N-A-X alloy steels produced. But out of this crucible of war—out of the extraordinary battle record of N-A-X alloy steels —will come new and better transportation equipment for peace and progress—new and finer products in a thousand other fields. For these versatile steels, service-tested on a score of battlefronts, will provide a complete and economical answer to the need of peacetime products in the world of tomorrow.

N-A-X ALLOY STEELS

GREAT LAKES STEEL CORPORATION

DETROIT, MICHIGAN

Sales Offices in Principal Cities

Division of **NATIONAL STEEL CORPORATION** *Executive Offices, Pittsburgh, Pa.*

UNITS PHOTOGRAPHED ACTUAL SIZE

Every One a Doggone Good Tool!

For big jobs—little jobs—everyday jobs—unusual jobs, all through the plant, in building and servicing planes, automobiles and machines—for all these, there's a dependable **Duro-Chrome** Tool designed to fit each specific job.

The two sockets illustrated suggest the wide range of sizes in which **Duro-Chrome** Tools are available. They typify, also, the quality production methods employed to insure stamina, precision and proper balance in every **Duro-Chrome** Tool. These sockets are produced by Duro's patented Hot Broached Method which forms the corners or teeth of the socket while the metal is red hot. Tears, stresses and cracks resulting from cold broaching (which may cause socket failure) are thus avoided.

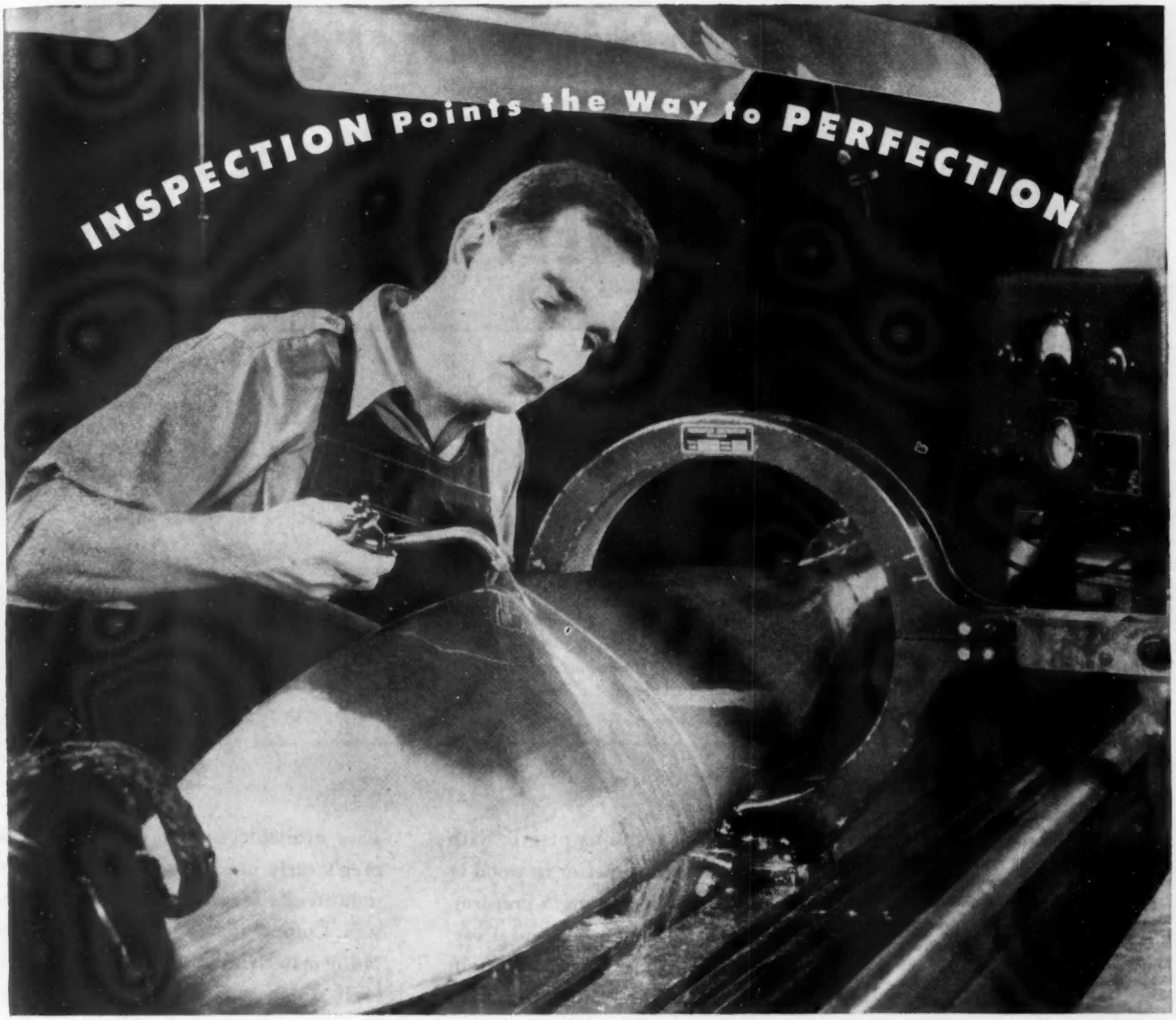
First call on the greatest tool production in Duro's history must necessarily go to our armed services and essential industry. So far as is consistent with these requirements, every effort is being made to provide you with such Duro tools as are essential to your needs. **Duro Metal Products Company, 2649 N. Kildare Ave., Chicago 39, Ill.**

DURO TOOLS (HAND TOOL DIVISION)

The Mechanic's Best Friend

OVER A BILLION BUILT SINCE 1916

ALSO MAKERS OF DURO MACHINE TOOLS



All this blade will ever cut is air but it is nevertheless manufactured with painstaking care. In the course of fabricating propellor blades from high strength steels, the A. O. Smith Corporation of Milwaukee repeatedly employs Magnaflux* inspection to detect the smallest flaw. The labor hours mount up in each blade, and nobody wants to work on one a second after it shows up defective —so the work is constantly checked by re-inspection.

This is the road to perfection. The part of Magnaflux in the vast technical improvement of the last decade has been to make possible speedy reliable non-destructive inspection for cracks and other defects inherent in steel or developed during processing or service—so speedy that it costs nothing in lost production time —and gains the user a reputation for flawless products. Shouldn't your plant be using Magnaflux?

Magnaflux—the Trade Mark of the Magnaflux Corporation applied to its equipment, materials, and methods for magnetic particle inspection.

MAGNAFLUX CORPORATION

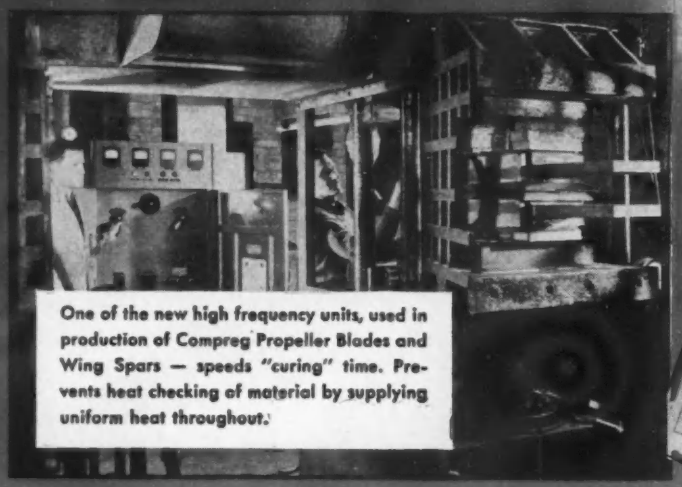
MAGNAFLUX CORPORATION

5904 Northwest Highway, Chicago 31, Illinois

NEW YORK • DETROIT • DALLAS • LOS ANGELES • CLEVELAND • BIRMINGHAM

Electronic Heating Increases Use and Extends Applications of PANELYTE* COMPREG

PANELYTE Compreg Propeller Blades — rotary cut veneer impregnated with phenol-formaldehyde. It possesses extremely high tensile, compressive and flexural strength. Carving is done by Engineering Research, Riverdale, Md.



One of the new high frequency units, used in production of Compreg Propeller Blades and Wing Spars — speeds "curing" time. Prevents heat checking of material by supplying uniform heat throughout.

This popular R.C.A. advertisement featured electronic heating apparatus used in manufacture of Compreg.

This laminated resinous plastic with wood veneer base is superior to wood in dimensional stability, strength uniformity and resistance to moisture and decay. Panelyte Compreg is superior to light alloys in weight saving and resistance to fatigue failure, erosion and corrosion.

"Gluing by radio waves" cuts "curing" time from hours to minutes — saving production time and costs.

Compreg is preeminently suited to all structural beam applications, within sizes available in the material. Compreg's early use in circuit breaker rods indicates its adaptability in electrical design. Compreg is also a good heat insulating material, and this, coupled with its high strength, makes it ideal for supports in magazines and cold storage units in ships. It prevents heat conduction from deck plates and bulkheads, which occurred when steel supports were used.

Samples and full technical data immediately available.

*Mass production of sheets, rods, tubes, molded forms and fabricated parts in paper, fabric, wood veneer, fibre glass and asbestos base thermo-setting plastics.

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS

★ There are plenty of new and exciting developments these days in precision pumps . . . in hydraulics and controlled liquid flow. Demands by modern aircraft for performance beyond the ordinary have led to many important improvements.

Out at PESCO we've been so busy developing and building all types of improved pumping equipment for these planes that there's been little time left to tell you all we'd like about how this new equipment can serve you.

But we've done the next best thing by preparing a book, which tells all we can right now, of many new developments that you should know about.

We'd like you to have a copy of this book. Already, requests for several thousand have been filled. Just drop us a line and your copy will be forwarded at once.

ASK FOR

Book entitled "Pressurized Power and Controlled Flow by PESCO".

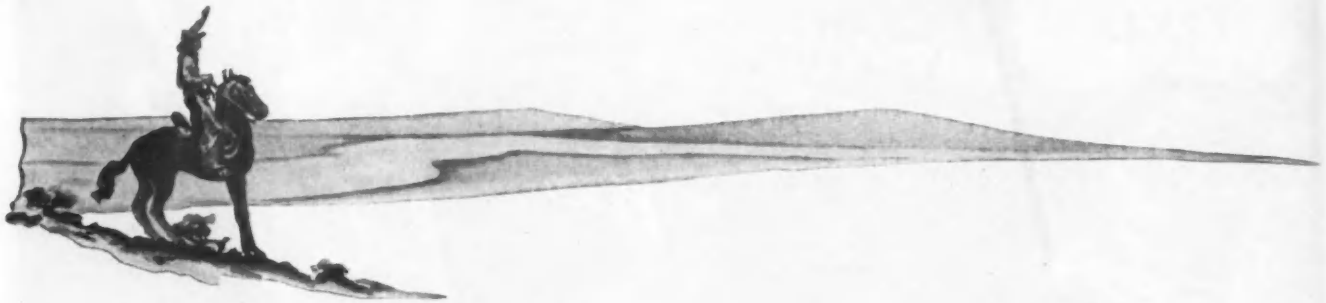
WRITE TO

PESCO Products Company
Industry Service A
11610 Euclid Avenue, Cleveland 6, Ohio

Division Borg-Warner

In Precision Hydraulics, Fuel Pumps, Air Pumps, Related Accessories . . . .
PERFORMANCE POINTS TO Pesco FIRST

Silver Horseshoes for the Mustang



Mallory Bearings have brought more than "horseshoe" luck to the Mustang fighter. These silver bearings, made by the Mallosil* Process, have produced a dependability of engine performance that plays no small part in Mustang achievements.

Flying faster and higher than any fighter plane heretofore . . . utilizing superchargers to carry it to over 30,000 feet . . . the Mustang achieves its tremendous speed and lift by using bearings capable of withstanding tremendous pressures and stresses. Ordinary bearings could not take such punishment. But Mallory bearings can and do!

Mallory has pioneered in developing these new silver-bonding methods so that users of aircraft and other heavy duty bearings now look to Mallory as a reliable source for precision production. Mallory facilities, expanded many times over to meet military needs, are recognized as the most advanced in the new techniques responsible for higher and higher levels of aircraft engine performance.

It is not difficult to foresee how much significance Mallory Bearings will have for post-war commercial aviation. But this is only one phase of the development. Wherever heavy duty, precision bearings are essential for improved engine performance, Mallory Bearings will have much to offer to design engineers planning for the future.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Do Something Extra—
Buy an Extra War Bond

*Reg. U. S. Pat. Off.

P R MALLORY & CO Inc
MALLORY

SERVES THE AVIATION, THE AVIATION-INSTRUMENT AND THE AVIATION-COMMUNICATION FIELD WITH WELDING TIPS, THE MALLOSIL* PROCESS—BEARINGS, SPECIAL ALLOYS, ELECTRICAL CONTACTS, VIBRATORS, VIBRAPACKS,* CONDENSERS, ROTARY AND PUSH BUTTON SWITCHES, ELECTRONIC EQUIPMENT, COMMUNICATIONS HARDWARE, RECTOSTARTERS*

Success or failure in metal fabrication and finishing depends on chemical cleanness. Paint and other finishes will temporarily cover an unclean surface but unless rust and rust producers, scale, grease and oil are eradicated, the finish breaks down prematurely, leaving the metal unprotected.

A recognition of this fact has led to much research and development of new and better materials and methods for cleaning and protecting metal surfaces. The American Chemical Paint Company has, for over a quarter of a century, devoted its research facilities to this particular chemical field, originating and developing products which have eliminated many problems of the metal-working industries.

These developments found ready acceptance in the automotive industry in pre-war days and, more recently, in the field of aeronautical construction, are affording material assistance in speeding and benefiting war production.

Deoxidine—By reason of its ability to eradicate rust and produce a steel surface clean chemically as well as mechanically, Deoxidine overcame one of the more serious difficulties of the automotive industry in its early days. Today, in aircraft production, Deoxidine is used to clean and condition metal surfaces for painting and also to clean and prepare aluminum surfaces to receive a uniform *Alrok coating.

Kemick—*A Heat Resisting Paint*—In the pioneer automobile days, Kemick provided a means for durably coating exhaust manifolds and exhaust lines that attained temperatures too hot for ordinary paints, eliminating the costly and more fragile coatings of vitreous enamel. Today, it provides protection for aircraft exhaust stacks and rings, as well as for automotive exhaust lines.

Rodine—*Pickle Bath Control*—Rodine made possible substantial savings in pickling acid, reduced the dissolution of metal and improved pickling conditions to an extent that pickling became a scientifically-controlled operation.

Deoxylyte—Early in the automobile age, Deoxylyte was developed as a means of controlling rinse baths in the metal-cleaning process at the proper pH so necessary to durable finish coats.

Peroline—Developed for the auto-body builder as a means of preventing rust and thus reducing the amount of Deoxidine required to clean bodies and sheet metal parts in preparing them properly for painting. Peroline is a combined cleaning chemical and oil which removes blushes of rust, destroys rusters on the material and preserves the clean surface.

Cuprodine—Steel surfaces are treated and coated with copper without the use of current. Cuprodine provided a new type of lubricant which was rapidly adopted by the steel industry in the drawing of wire, and by others to facilitate difficult drawing of steel shell cases and machine parts.

Other Products—The above are but a few developments of ACP research. Other products none the less important include:

Pickle Bath Toner — Improves pickling of oily work.
Cuprotek—Copper Coating Protection.
Flosol—Soldering Fluxes.
Ridoline—Alkaline Cleaners.
Ridosol—Improves detergent properties of Alkali Cleaners.
Solvent No. 3 — Speeds paint and enamel removal.
Lithoform — Makes paint adhere to zinc surfaces.
Metal Stripping Solution No. 2—Provides a rapid and efficient method of removing coatings of copper, lead, zinc, cadmium and magnesium.

These are typical of the many chemical products which have been developed by the American Chemical Paint Company for use in cleaning, pickling, and the fabrication of metals. American Chemical Paint Company solicits an opportunity to assist you.

Manufacturers of Inhibitors & Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.

AMBLER ACP **PENNA.**

Descriptive literature covering application of Deoxidine and Deoxylyte in cleaning and rinsing operations will be sent free on request to

AMERICAN CHEMICAL PAINT COMPANY, AMBLER, PA.
Please send me general Technical Service Data Sheets on
☐ Cuprodine ☐ Cuprotek

Name ..... *Title* .....

Company .....

Address .....

K-7

*Reg. T. M. Aluminum Co. of America.

CHEMICALS ACP PROCESSES

Advertisement

You Can Depend On Us For

Fabricated Metal Tubing

OR TUBING AND STAMPING ASSEMBLIES

● Because of our years of experience in volume production of metal tubing and stampings, we may have the exact facilities and the "know how" to fabricate what you need, to your advantage.

Noblitt-Sparks makes and forms metal tubing into any shape—welds it to other parts stamped from metal—assembles, plates or paints the entire unit—ready to go into your product. We've been doing that for many manufacturers—for 25 years—companies who have depended on us for many different kinds of assemblies. Perhaps we can help you, now or later—with engineering assistance, as well as production. If you have a specific job in mind, write or call . . .

Harlow Faulke

Vice-President and Director of Manufacturer's Parts Division

NOBLITT-SPARKS INDUSTRIES, INC. • COLUMBUS, INDIANA

CHECK GEARS

For

NOISE, TOOTH BEARING AND NICKED TEETH

There is no economy in assembling gears only to find out then that they are too noisy and will have to be replaced. You can always find out just how noisy gears are going to be by means of the Red Ring Sound Tester. Also, by the character of the gear sound made, you will be able to diagnose the reasons for the noise.

Sound from the gears running together in the sound chamber is amplified 50 times by the acoustical horn. All external sounds are excluded so that the sound tester may be used right out in the open shop—no special room is needed.

This machine is used also for checking tooth bearing under light loads and for discovering nicked teeth, especially in transmission, timing and engine gears—automotive and aircraft.

Under light brake loads gears can be tested at four speeds in both directions of rotation. The center distance between spindles is adjusted by precision gage blocks. Standard machines accommodate gears up to 18" O. D.

WRITE FOR DESCRIPTIVE BULLETIN

NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

5600 ST. JEAN • DETROIT 13, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

—Says the WASP to the HELLCAT:

ONE of the newest — fastest — deadliest of the U. S. Navy's fighter planes is the Grumman Hellcat. Power Plant for the Hellcat is the Pratt & Whitney Double Wasp engine. A tough combination for any Axis pilot to encounter!

Here at Permite we take particular pride in the Hellcat's record, because we have made a distinct contribution to the engine that powers it. The front reduction gear drive housing as well as other vital parts of the Wasp Engine are Permite Magnesium Alloy Castings.

We claim none of the credit for the Hellcat's accomplishment. That credit belongs strictly to the men who fly the ships. But we do know you will agree that Permite Aluminum and Magnesium Castings — good enough to deserve their place in America's fighting ships — must have the quality to meet your requirements.

Inquiries from war production manufacturers given prompt attention. We are also glad to consult with your engineers on postwar designs.

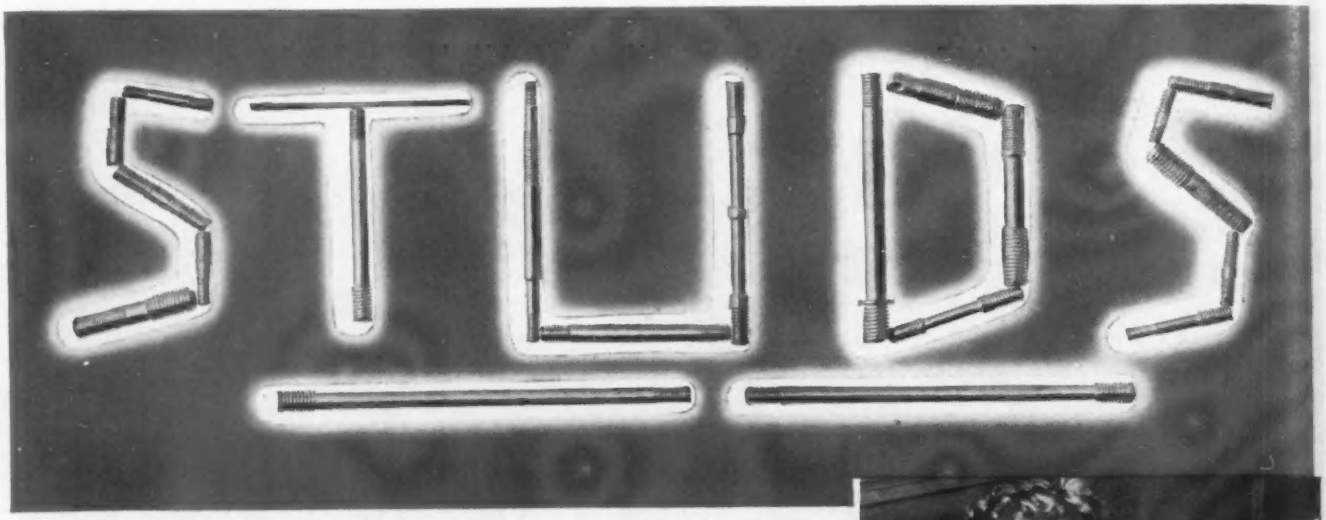
ALUMINUM INDUSTRIES, Inc.
Cincinnati, Ohio

Detroit: 809 New Center Building Chicago: 616 South Michigan Avenue
Los Angeles: 324 N. San Pedro Street

•

PERMITE ALUMINUM AND MAGNESIUM ALLOY CASTINGS

TOOLS FOR
Accurate
THREAD CUTTING
Here you see a small portion of one day's harvest of dies from Pratt & Whitney's Small Tool Division. These round split dies are but one of many types of accurate thread cutting tools we make, including thread-rolling dies.
All over the nation, P&W thread cutting tools of various kinds are turning out top-notch threads . . . rapidly . . . at low cost. Other Pratt & Whitney small tools include cutters, reamers, taps, dies, punches, drills, counterbores, special tools of all kinds. Mechanics everywhere know and like P&W Small Tools . . . precision made by master craftsmen . . . of highest quality uniform steels . . . scientifically heat treated to maintain their keen cutting edges.
Try P&W Small Tools on your next order. For information phone the P&W Branch Office nearest you, listed below.
Branch Offices and Agencies—BIRMINGHAM BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT
LOS ANGELES NEW YORK PHILADELPHIA PITTSBURGH ROCHESTER SAN FRANCISCO ST. LOUIS
PRATT & WHITNEY
Division Niles-Bement-Pond Company
WEST HARTFORD • CONNECTICUT



Close Inspection at EVERY Stage Insures Precision Aircraft Studs

Closely controlled processes on a volume production scale have made National Screw a principal source of supply for Aircraft Studs.

Here's what it takes:

1. A special Aircraft Stud Department with personnel trained for this particular work.

2. Close control of every operation, from drawing of wire in our own wire mill to final inspection.

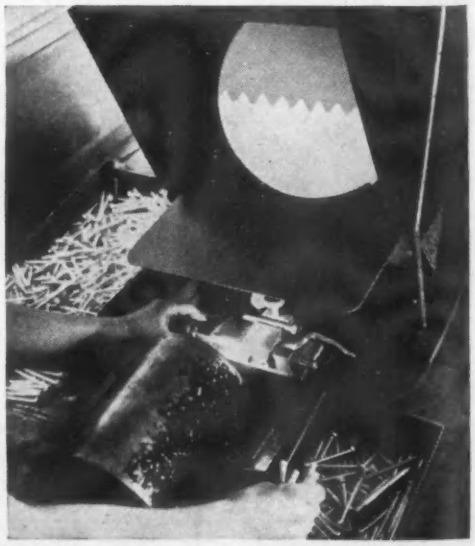
3. Modern heat-treating facilities under expert laboratory control.

4. Inspection at every stage of process, including individual snap gauge inspection of each piece. Additional facilities for projection method of inspection.

We are equipped to handle a full range of sizes up to ½ inch diameter and to produce precision threads without milling or grinding—steels and plating to meet AN specifications.

National HEADED AND THREADED PRODUCTS

Aircraft studs are checked for required tolerance by 100 per cent roller snap gauge inspection.



Thread form comparator provides additional check by projection to 50 times actual size.

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

Signal Corps Photo

JUST AS DAVID STOPPED GOLIATH

—these little 37 mm. anti-tank guns are stopping huge enemy tanks.

They are so light in weight that they can be moved by hand—but they pack a terrific wallop. Their 2-pound shells can pierce 1½ inches of armor plate at 1000 yards.

High velocity and tremendous pressure—over 35,000 p.s.i. in the powder chamber—exert severe transverse stress in the barrels of these guns.

The steel from which the barrels are made must be UNIFORMLY sound —UNIFORM in response to heat treatment—UNIFORMLY clean and free from inclusions to insure against defects in the bore and rejects following costly machining.

That's why so many 37 mm. gun barrels are forged from Republic Electric Furnace Steels—the steels that are as CLEAN and SOUND as the most expert furnace practice can make them.

These fine steels have helped make possible many of our world-leading implements of war, because they are "targeted" by the precise control possible *only* in electric furnace melting to *invariably* hit narrow specification marks. With them, results can be predetermined *accurately.*

Their freedom from practice-upsetting variables—their consistent homogeneity—their uniform physical, chemical, hardening, fabricating and performance values—effect maximum efficiency in mass production.

A Republic metallurgist is ready to discuss with you and your technical staff the advantages of Republic Electric Furnace Steels as applied to YOUR peacetime products. When may he call?

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Bldg., New York 17, N. Y.

REPUBLIC
—Leader in the Production of
ELECTRIC FURNACE STEELS
"QUALITY" steels . . . alloy . . . stainless

As Warplane Designs Stabilize . . .

Rely On the Same **DOLE** Engineering Cooperation

for FUTURE DESIGNS

the DOLE valve company

Established 1906

1901-1941 Carroll Ave., Chicago 12, Illinois • Los Angeles • Detroit • Philadelphia

Made in Accordance With Army and Navy Aeronautical Standards.

All the facilities of the N. A. Woodworth Company are devoted to one purpose . . . The manufacture of precision tools and gages with the longest accurate life . . . To give users the lowest possible operating costs.

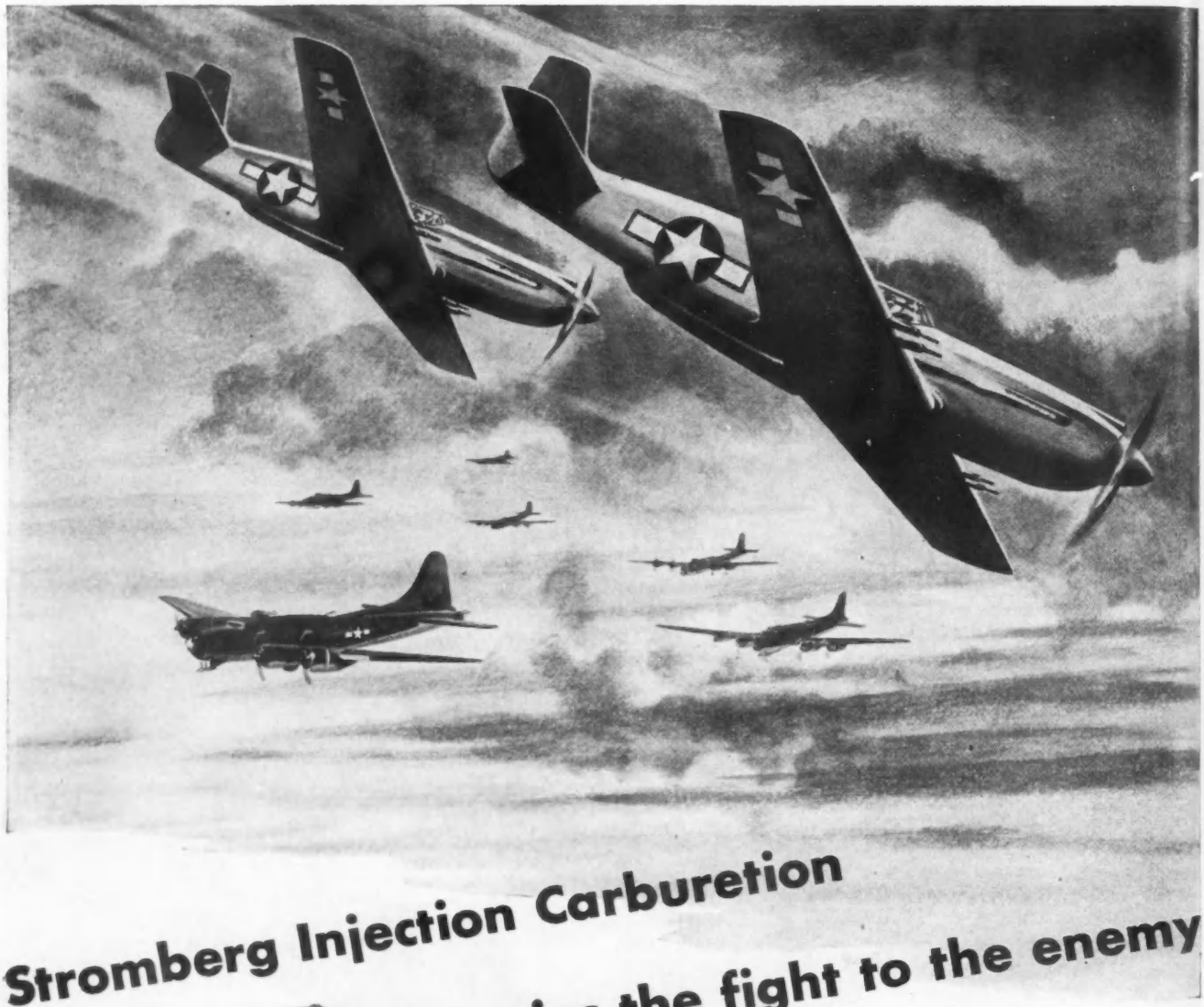
Reduce your production expense with sustained accuracy by Woodworth. Wire for stock list today.

ACCURACY YOU W CAN TRUST

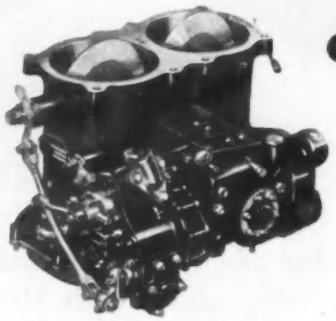
WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • GROUND THREAD TAPS • FORM TOOLS • PRECISION MACHINED PARTS • HEAT TREATING • PLATING



Stromberg Injection Carburetion carries the fight to the enemy



FOR TOP-FLIGHT PERFORMANCE

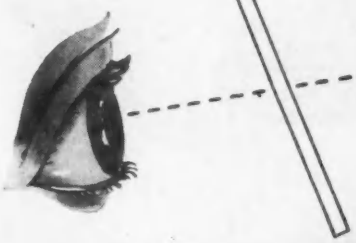
The Stromberg Injection Carburetor has considerably increased the *ceiling* as well as the range of fighting and bombing planes. And Bendix—with the finest research facilities in its field—continues to make improvements. Watch Bendix for the latest advancements in Injection Carburetion.

Sorties into the heart of Europe and beyond are commonplace today—*and one basic reason is Stromberg Injection Carburetion.* **By automatically assuring the most economical mixture of fuel and air under all conditions of altitude, speed, position and temperature, these precision-built carburetors extract many extra miles from every gallon of gas. Standard equipment on the finest, fastest Allied fighters and bombers today, these products of Bendix Creative Engineering hold great promise for the commercial airlines of tomorrow.**

Bendix PRODUCTS DIVISION

Bendix Aviation Corporation • South Bend, Indiana

The driver responds . . . to what his eyes have seen through glass



Provide Greater Clarity . . . Better Visibility with L. O. F. POLISHED PLATE GLASS

HI-TEST L O F SAFETY PLATE

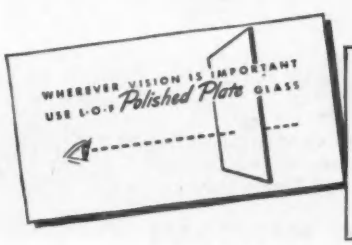
A driver's eyes work hard while a car is in motion. Curves, bumps, pedestrians, passing cars—these and thousands of other details must be watched attentively, constantly.

Any optical distortions that make seeing more difficult contribute to eye fatigue and, consequently, to highway danger. Even minor distortions, not noticeable at a casual glance, can lead to fatigue when eyes must compensate for them over long periods of time.

That is why the use of Polished Plate Glass throughout the car is an important factor in promoting highway safety—for this glass is clearer, flatter and freer from optical distortions.

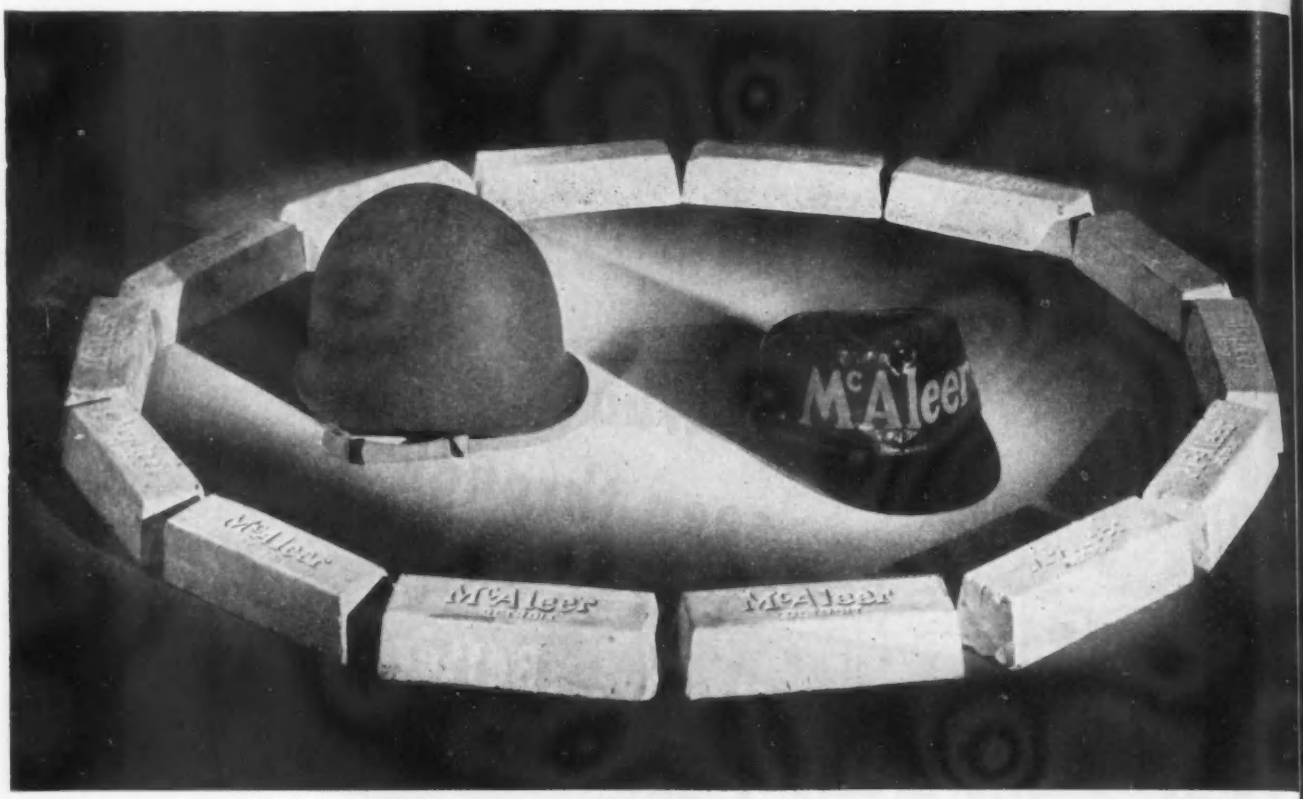
As you design your postwar cars, remember the close relationship between good visibility and greater safety. In the manufacture of Libbey·Owens·Ford Hi-Test Safety Plate Glass, two ground and polished lights of plate glass are laminated with a clear, tough plastic interlayer. Thus maximum clarity of image is assured. Libbey·Owens·Ford Glass Company, 4074 Nicholas Building, Toledo 3, Ohio.

Reduce eye fatigue and its resultant dangers by providing *good* visibility with *good* glass—L·O·F Polished Plate Glass.



L O F **LIBBEY·OWENS·FORD**

a Great Name in **GLASS**



Our Hats Are In The Ring . . *for Victory and "C" Day*

THIS is a year of campaigns—campaigns for Victory on the War Fronts—campaigns to win the Peace on the Home Front—your own campaign for Post-War Business—with vital issues to be decided now, if you are to meet competition, keep your men at work, yes, even stay in business.

In the Campaign for Victory, "D" Day will ever be remembered. With Victory won, will come still another day no less important to the Campaign for Peace—"C" Day—the day of conversion to peacetime manufacture. This is the day that will keynote the struggle of every American business as it makes its bid for existence in the post-war world. Already many materials are becoming less critical. It's time you looked over the qualifications of likely materials for your post-war products. Many will compete for your vote—glass, plastics, wood, aluminum, new alloys, new steels. The choice won't be easy — for the one you elect must provide your product with the most in durability, efficiency and appearance.

If an improved finish can increase the durability, efficiency and appearance value of your product—then McAleer resourcefulness can be of service to you. For many years McAleer service has been characterized by a probing, restless impatience with ordinary finishing materials and methods. Since America's entrance into the war, our efforts to serve industry have led to developments in wartime finishes so far superior to those produced for prewar products, the contrast is truly amazing.

McAleer's war record of achievement in producing *quality-controlled* finishing materials with an almost unbelievable versatility of applications can only be excelled by the results we are prepared to produce when new and strategic materials are made available for your post-war product use.

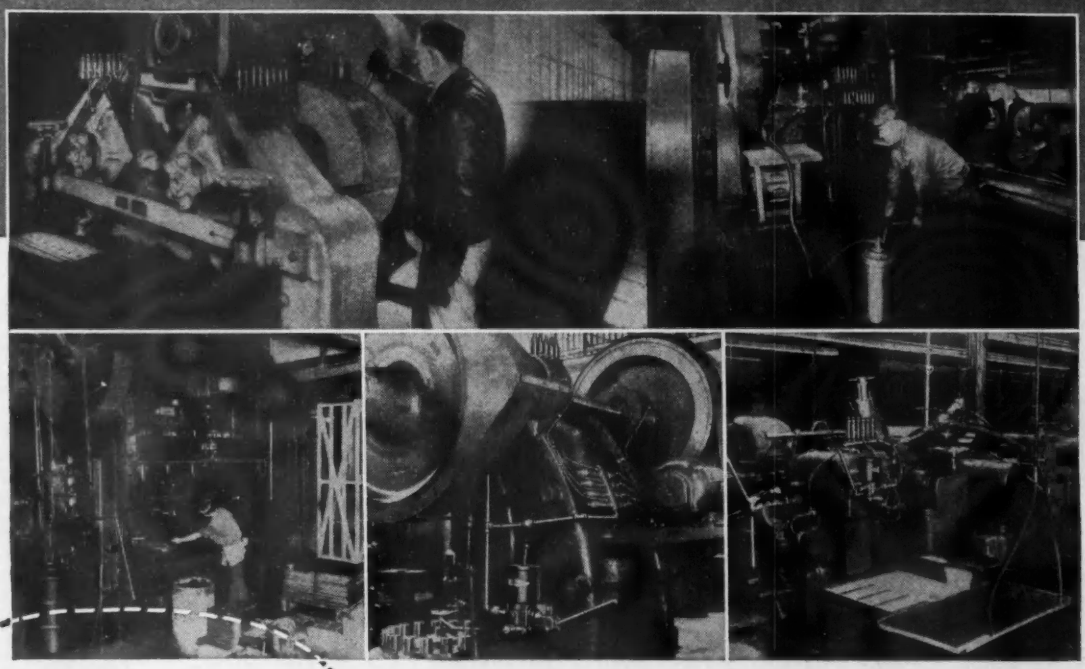
No manufacturer concerned about the present or future can afford to overlook the extra values that an improved finish can give his war or post-war product. *OUR HATS ARE IN THE RING . . . for Victory and "C" Day.* We'd like to present the qualifications of our candidates to meet your particular war and post-war finishing requirements.

McAleer MANUFACTURING CO.

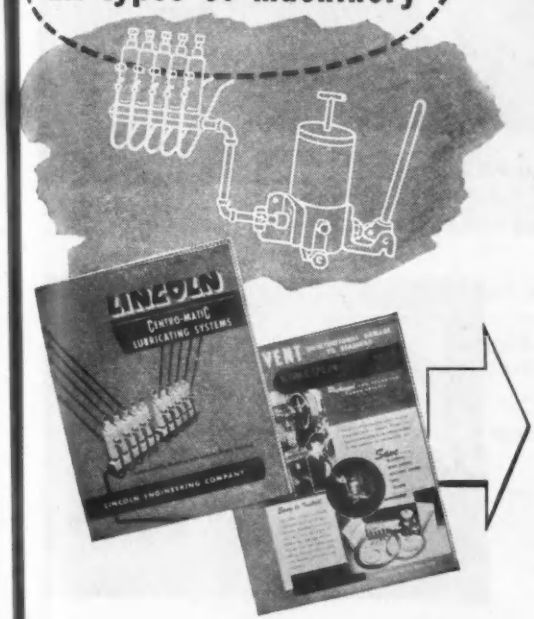
Manufacturers of Quality-Controlled Finishing Materials, Military Aircraft Sub-assemblies and Pyrotechnics . . .

ROCHESTER, MICHIGAN

LINCOLN CENTRO-MATIC LUBRICATING SYSTEMS...



THE *Modern* WAY TO LUBRICATE all types of machinery



The Lincoln *modern method* of centralized lubrication, makes it possible for all bearings on one machine, or on a series of machines, to be lubricated from a central source without stopping the machines.

The Lincoln Centro-Matic System consists of a number of Centro-Matic Injectors—one for each bearing—and a hand-operated, or a power-operated Centro-Matic Lubricant Pump. The system is easy to install and will help increase your plant efficiency, not only today, but for years to come.

I WOULD LIKE TO HAVE FREE BULLETIN
On Lincoln Centro-Matic Lubricating Systems.

*Name*_____
*Title*_____
*Company*_____
*Address*_____
*City*_____ *State*_____

AAI 144-7D

ARMY E NAVY

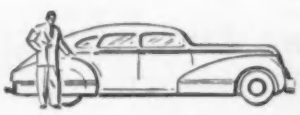
LINCOLN ENGINEERING COMPANY
Pioneer Builders of Engineered Lubricating Equipment
5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.

Illustration is from Inland poster showing an operation in the production of an Inland-made part for marine craft

In peacetime, Inland is one of the world's largest users of synthetic and natural rubber combined with metal. In wartime, Inland's long experience in the compounding, molding and finishing of both tree-grown and chemically produced rubber was quickly and successfully applied to the manufacture of many parts for Diesel engines used in submarine chasers, torpedo boats and landing craft.

INLAND MANUFACTURING DIVISION
General Motors Corporation, Dayton, Ohio

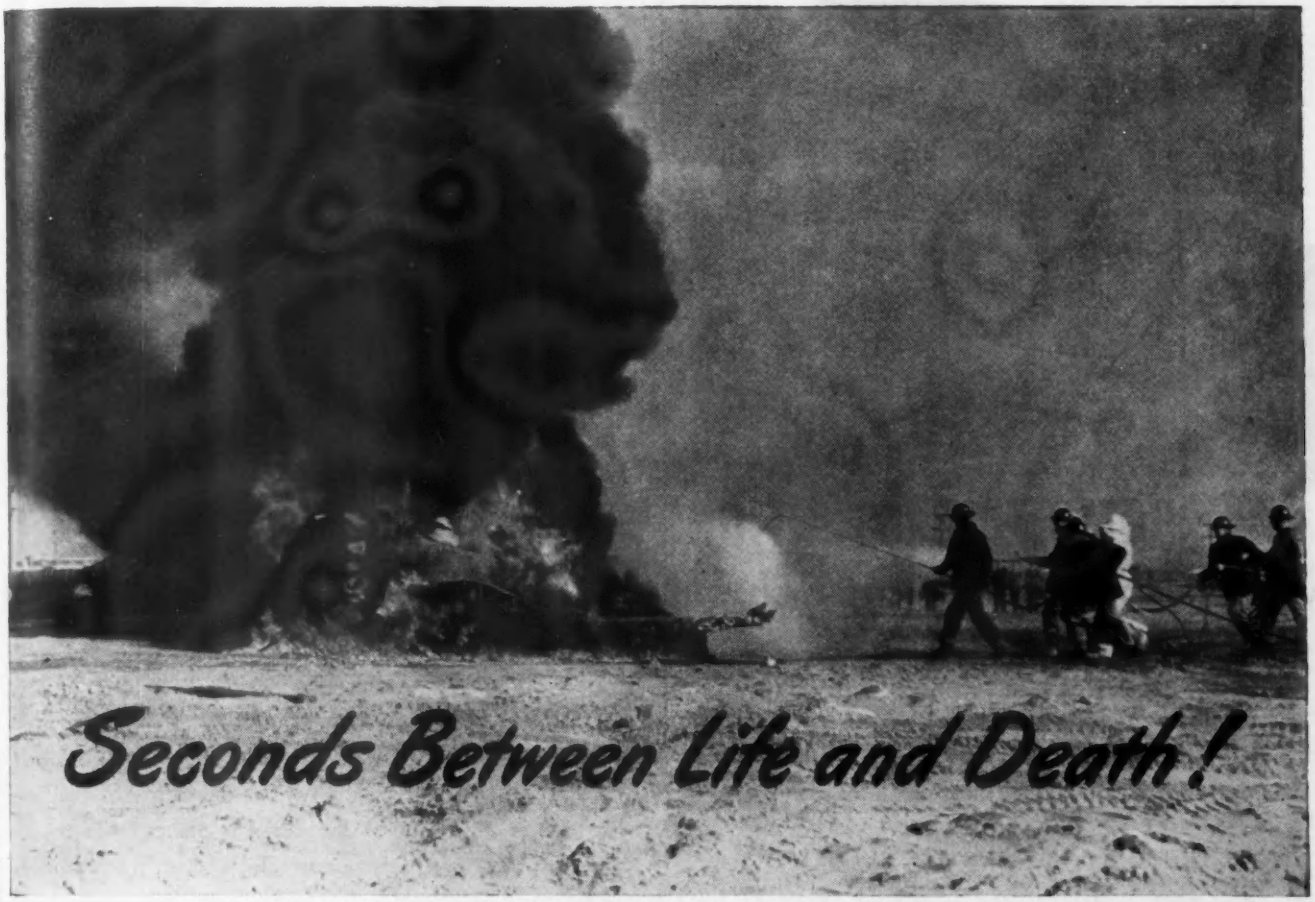
Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns and Rubber, Synthetic Rubber and Metal Parts for Tanks, Aircraft, Submarine Chasers, Torpedo Boats, Artillery Lighters and Landing Craft.



INLAND

Manufacturing

RUBBER, METAL, PLASTICS



FMC "Fog" Fire Fighter, Equipped with Federal-Mogul Bearings, Saves Lives Around the World

When a plane comes crashing down to earth and bursts into flame—a few seconds may determine whether that pilot will live to fly again. The Food Machinery Corporation has met Death's challenge with its new high-pressure "fog" fire fighter unit which smothers fire in a few seconds—sufficient to let an asbestos-clad worker enter the plane to pull pilot and crew to safety. Then it is just a matter of minutes until the entire fire is completely extinguished.

The FMC pumping unit, which is equipped with Federal-Mogul sleeve bearings, develops 800 pounds of pressure to deliver 60 gallons of "water fog" per minute, to provide dependable emergency fire fighting service on air stations around the world.

Tens of thousands of bearings, bushings and similar precision parts leave our six well-equipped plants daily to serve on America's weapons of war. As the war ends, we will turn, almost without interruption, to bearing production for the automobiles, trucks, refrigerators, diesel engines, tractors and many other much-needed peacetime power units. Wherever shafts turn in sleeve bearings, for 45 years FEDERAL-MOGUL sleeve bearings have been the recognized standard of dependable quality.

FEDERAL-MOGUL CORPORATION, DETROIT 13, MICHIGAN

Bearing Specialists Since 1899

Sleeve bearings and bushings designed, developed and manufactured for engines, pumps, compressors, large machine tools and all applications where such parts are used.

Manufacturers of Equi-Poise and Tru-Pitch marine propellers from 4 inches to 12 feet diameter; Equi-Flex cushion stuffing boxes and shaft logs; struts, rudders, propeller shafts.

FEDERAL-MOGUL

SLEEVE FEDERAL Mogul **BEARINGS**

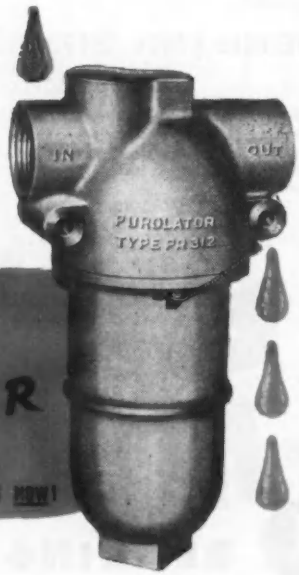
BOMBER PROTECTION

with a special kind of fighter

Without protection against dust and dirt, even the mightiest bomber is hopelessly handicapped. Close-fitting parts of its hydraulic system are soon damaged by gritty abrasives. Wing flaps and landing gear get out of commission, due to the sticking and clogging of valves.

To overcome this danger, Purolator has developed a series of hydraulic filters with special micronic elements that meet every requirement of the Army and Navy. The elements are small in size, light in weight and completely impervious to weather conditions. So effective are they in isolating dirt, that even the smallest foreign particles are trapped and eliminated.

In addition to hydraulic oil filters, Purolator also manufactures highly efficient air filters for vacuum operated aircraft instruments, and a complete line of lubricating oil filters. Write for Purolator's "Aviation" Catalog. Purolator Products, Inc., Founder and Leader of the Oil Filter Industry.

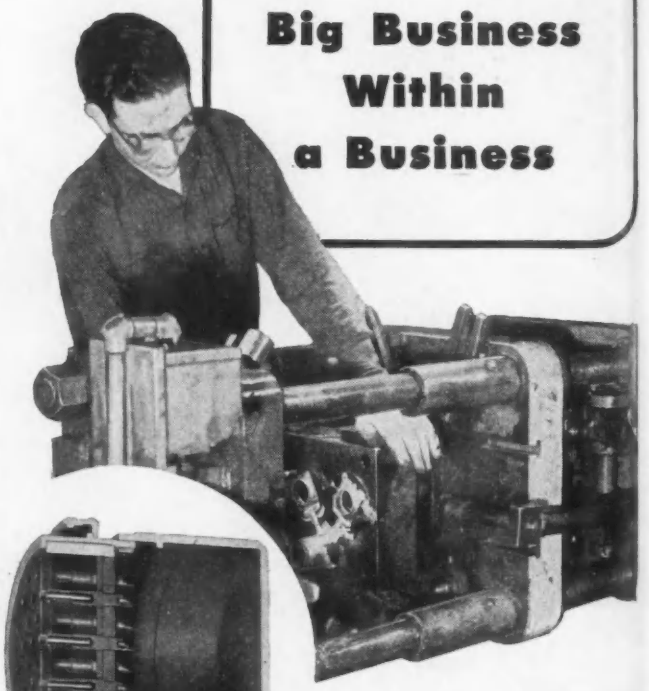


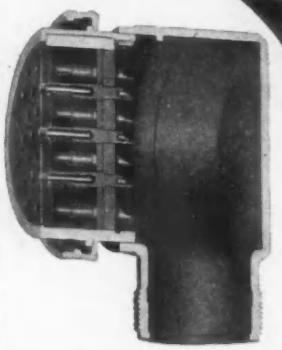
Home Office . . . . . Newark 5, N. J.
Detroit Office . . . . . 609 Fisher Bldg.
Calif. Office . 1401 S. Hope St., Los Angeles

KEEP IT CLEAN with PUROLATOR

BUY MORE WAR BONDS AND STAMPS NOW!

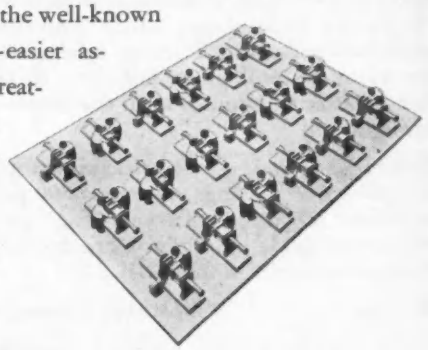
Big Business Within a Business

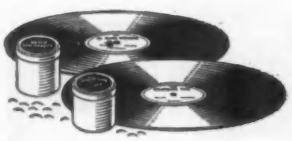




Cannon Quality Control makes some exacting demands—for instance die castings so intricate and precise that ordinary sources can't supply them profitably and in quantity.

So we built, equipped and staffed our own die casting department. It's a big one—rates among the five largest aluminum alloy die cast plants in the country. It has a huge capacity—much more than even we need. But its size assures our customers prompt delivery of almost any quantity of Cannon Connectors, on short notice without the slightest sacrifice of the well-known Cannon qualities—easier assembly, better fit, greater strength with less weight, longer trouble-free life.





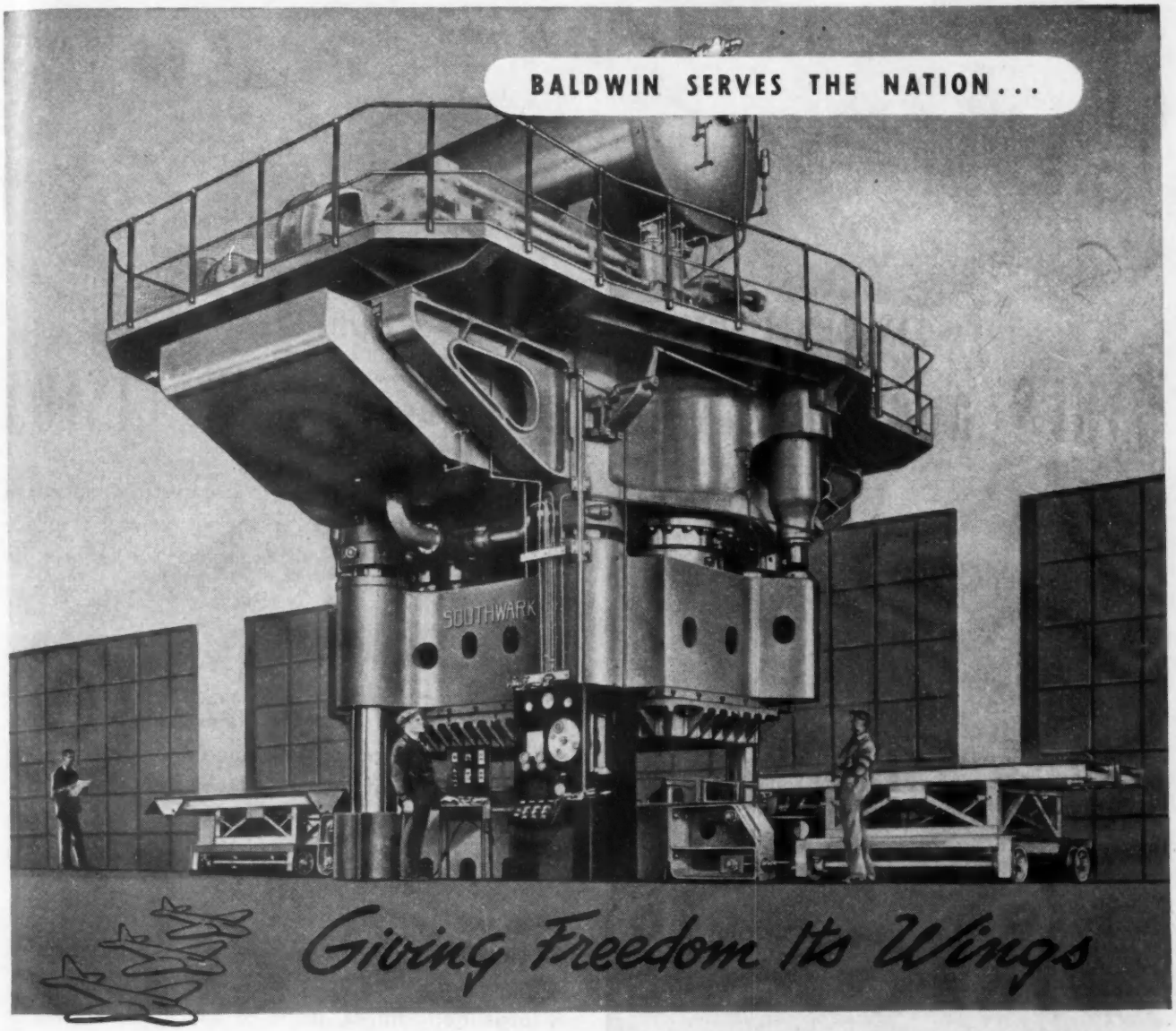
Cannon slide films with sound covering assembly and soldering techniques are available on request. Address Dept. A-109, Cannon Electric Development Company, 3209 Humboldt St., Los Angeles 31, Calif.

CANNON ELECTRIC

Cannon Electric Development Co., Los Angeles 31, Calif.

Canadian Factory and Engineering Office:
Cannon Electric Company, Limited, Toronto

Representatives in principal cities — consult your local telephone book



When the astronomical quota on U. S. plane production was set, aircraft manufacturers needed special presses, as quick as *yesterday*.

Fortunately, Baldwin didn't have to stop and learn *how* to build such equipment; 30 years of experience in building thousands upon thousands of presses took care of that. Manufacturers told what they wanted the presses to do . . . and Baldwin built them to do it.

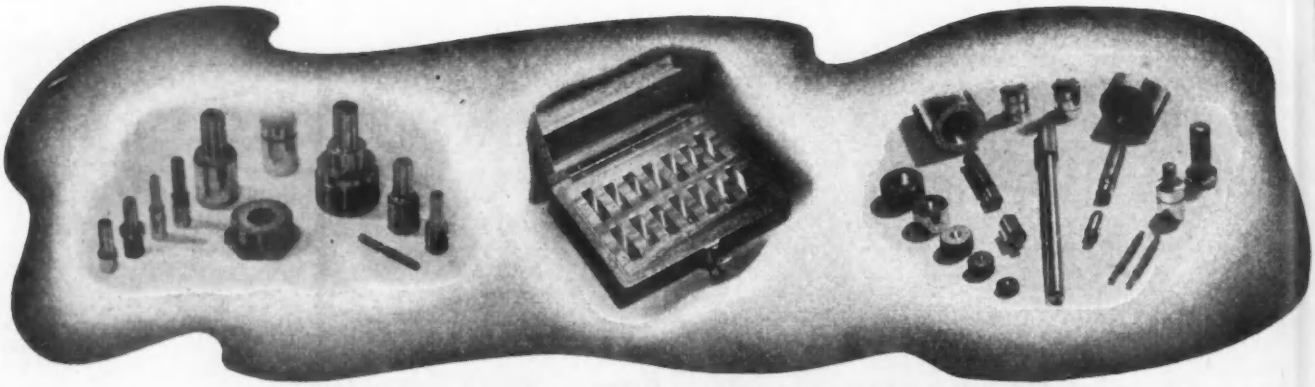
You may have some production problems . . . current or post-war . . . that the right press could solve better than anything else. If so, the same Baldwin brains that served the aircraft industry are ready to serve you. Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia, Pennsylvania, U. S. A. Pacific Coast Representative: The Pelton Water Wheel Co., San Francisco, California. In Canada: United Steel Corp., Toronto.

BALDWIN
PRODUCTS

Hydraulic presses
Testing equipment
Steel forgings and castings
Diesel-electric locomotives
Diesel engines
Metal plate fabrication
Rolled steel rings
Bronze castings
Heavy machine work
Crane wheels
Bending rolls
Plate planers
Babbitt metal
Alloy iron castings
Briquetting presses

BLW THE BALDWIN GROUP

BALDWIN
SOUTHWARK
HYDRAULIC PRESSES



LINCOLN PARK HAS ALWAYS PRODUCED

GAGES and TOOLS of *Lasting* PRECISION

TRUE value and economy in gage use is measured in wear resistance . . . in the inspection accuracy which is maintained well along in the service life of the gage.

It is natural to think of gage wear resistance in terms of materials. Lincoln Park Carboloy gages are known to offer at least fifty times and Lincoln Park chrome plated gages approximately five times the wear resistance of those made of steel. But in any material, and especially in steel, a high surface finish is of paramount importance in guaranteeing a long, accurate service life.

At Lincoln Park, careful control in grinding and lapping produces gages with extremely high finish. A large department, parts of which are shown at the left and which is operated under ideal working conditions and staffed with highly skilled men and women, is devoted to lapping operations alone. Here Lincoln Park Class XX and X gages are finished with Profilometer readings no greater than 1.5 microinches. Readings no greater than 2.5 microinches are guaranteed on Class Y gages.

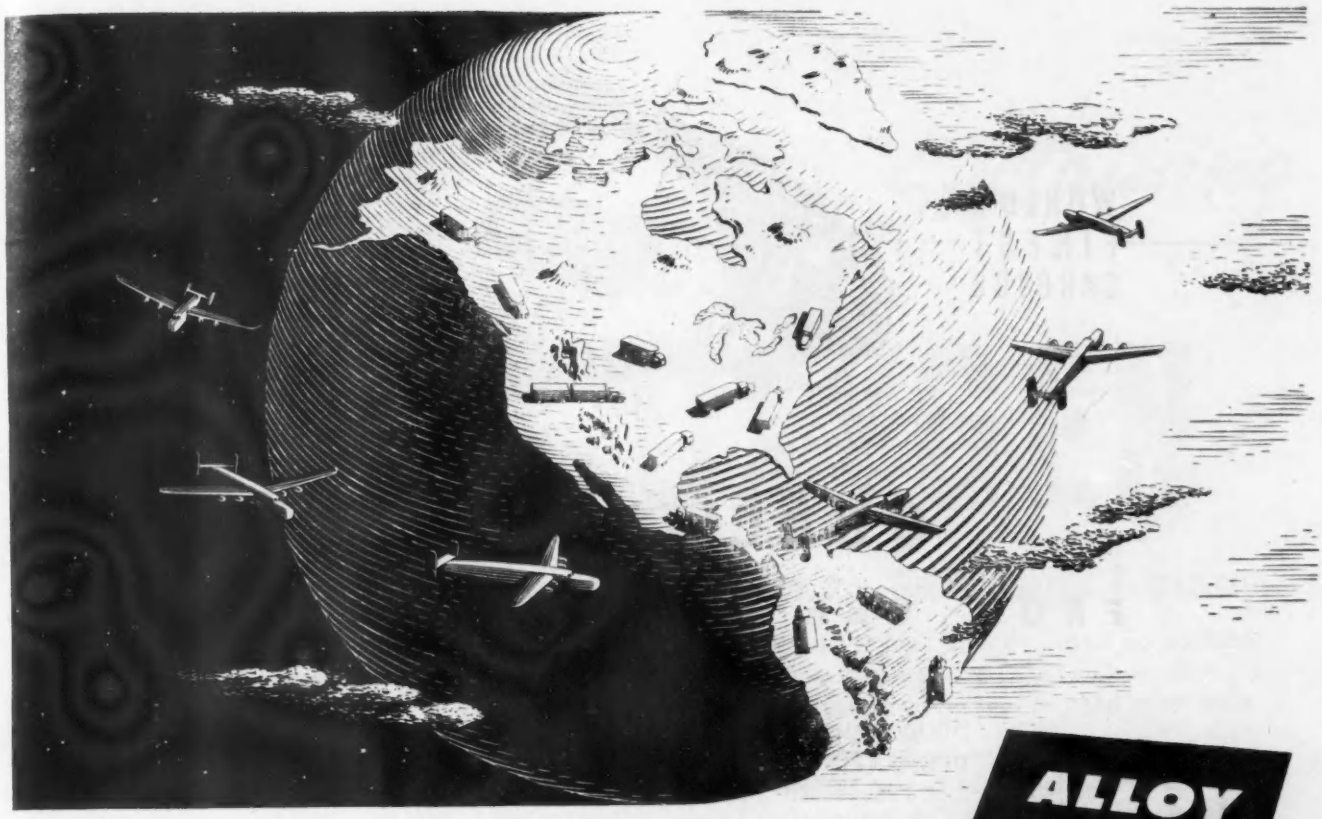
From Lincoln Park you get gages . . . and many types of precision tools . . . all of which are manufactured to provide the maximum in *lasting* precision.

ARMY (E) NAVY

LINCOLN PARK INDUSTRIES, INC.

Successor to The Lincoln Park Tool and Gage Company and Carbur, Inc.

1727 FERRIS AVENUE • LINCOLN PARK 25, MICHIGAN



For bigger pay loads - build light with

ALLOY STEEL TUBES

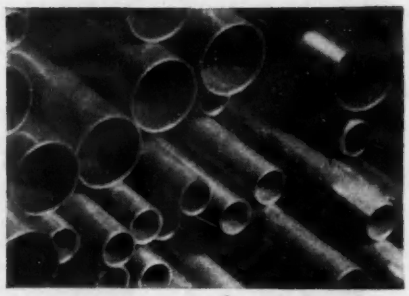
THE most successful carriers are those which can absorb the punishment of long, tough hauls, carrying the largest payload possible. Many designers of trucks and transport planes insure the performance of vital parts *and keep unprofitable dead weight at a minimum* by specifying seamless alloy steel tubing.

Pierced from solid billets of alloy steel, seamless alloy tubing makes for strong, rigid construction, relatively light weight, resistance to corrosion, heat and abrasion. It withstands impact, shock and fatigue, *and it has a higher strength-weight ratio than any other type of construction.* In axles, housings, torque tubes, frames and bearings, and for framework, landing gears, spar chords and other airplane applications, tubular alloy steel stands up through long, hard service.

Tubular Alloy Steel Corporation products went into this war with the background of 50 years' tube-making experience behind them. Now, tested extensively by the rigors of battle and improved to satisfy the exacting demands of modern war, these products are preparing to go into the postwar era as the finest alloy steel tubing that advanced metallurgical research and up-to-date materials and processes can produce.

Tubular Alloy Steel Corporation makes all sizes of tubes from ¼ inch to 8⅝ inches in the current ranges of alloys, in the customary wall thicknesses.

If you are striving to speed production on essential war equipment or if you are planning for construction after the war, write us for further information on seamless alloy steel tubing.



The newest name in alloy tubing

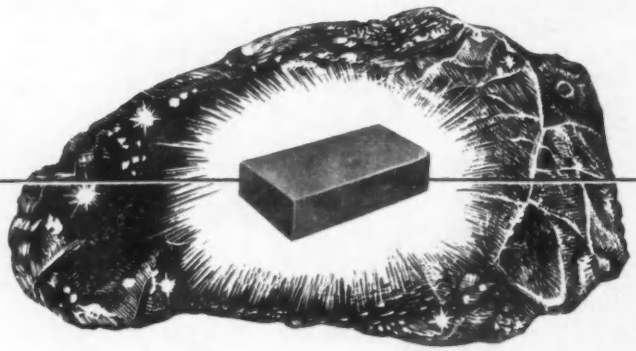
TUBULAR ALLOY STEEL CORPORATION

Gary, Indiana

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

WORLD'S FINEST CARBIDE



QUALITY CONTROL

FROM ORE TO FINISHED PRODUCT

Shop superintendents throughout America's metal-working plants can tell you that steel-cutting time is saved and superior results are obtained by Vascoloy-Ramet Carbide Tools.

"Vascoloy-Ramet" was the *first* successful cemented Carbide developed for machining steel. It has been painstakingly maintained as the *number-one quality* by *complete control* of processing Tantalum-Tungsten Carbides from the crude ore to the finished product.

Vascoloy-Ramet Corporation and Fansteel Metallurgical Corporation (world's foremost producers of Tantalum) work hand in hand, to maintain the quality of the world's finest Carbide. Advanced methods of manufacture have now lowered the cost to the user!

Tools are now supplied in two finishes, Unground and Finish Ground. Unground Tools have all the angles and clearances formed and are very practical for shops having the equipment to grind their own tools. Unground Tools offer a substantial saving in cost. Finish Ground Tools are ready for use and are the finest quality tools known to industry.

WRITE FOR PRICE LIST 280A

If you are not getting maximum machining efficiency in minimum cutting time, try Vascoloy-Ramet Tantalum-Tungsten Carbide Tools.

VASCOLOY Ramet RAMET CORPORATION

VASCOLOY-RAMET CARBIDE TOOLS AND TANTUNG CAST ALLOY CUTTING TOOLS

4454

NORTH CHICAGO • ILLINOIS

DISTRICT SALES & SERVICE IN PRINCIPAL CITIES

Official photograph
U. S. Army
Air Forces

They Breathe Life Sustaining OXYGEN

Generated by Independent's Mobile Oxygen Generators

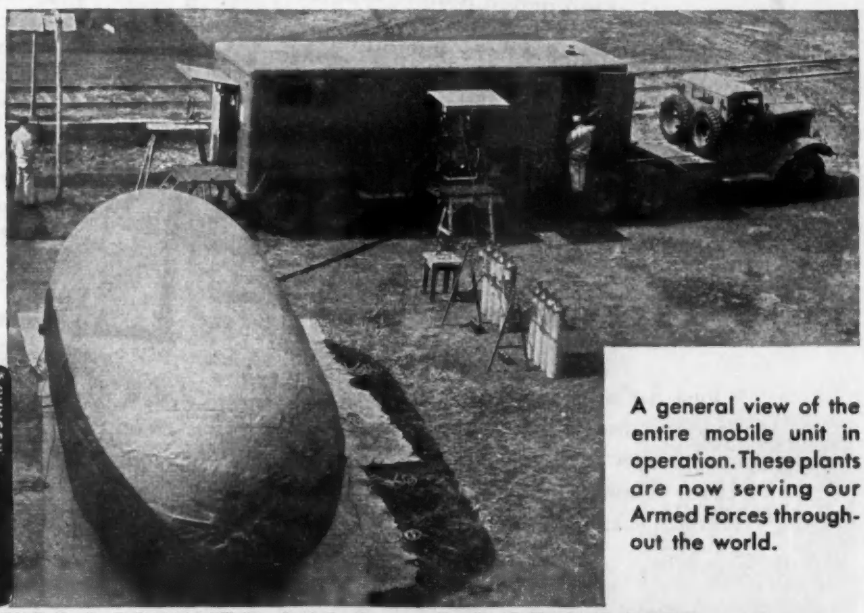
Oxygen is an absolute essential to the flight personnel on bombing missions, and, for all high altitude operations. To keep planes at these higher and safer altitudes, a supply must be kept on hand at all times.

Independent Mobile Oxygen Generators *make* the oxygen and *compress* it into high-pressure storage cylinders right at the air base. This solves the former transportation problem . . . when cylinders had to be returned to a faraway charging plant for refilling.

That procedure often required as much as three months for a round trip, but with Independent's Mobile Oxygen Generator it is reduced to a matter of hours, in many cases. From these high-pressure cylinders, transported to the planes on Independent Hand Trucks, the oxygen system of the plane is charged directly through a hose connected to to the system.

". . . The White Star, which the renewal adds to your Army-Navy Production Award Flag, is the symbol of appreciation from our Armed Forces for your continued and determined effort and patriotism."

Sincerely yours,



A general view of the entire mobile unit in operation. These plants are now serving our Armed Forces throughout the world.

INDEPENDENT ENGINEERING COMPANY, Inc.

Manufacturers of Mobile Oxygen and Hydrogen Generators • Builders of Oxygen, Hydrogen and Acetylene Plants • Manufacturers of Industrial Gas Cylinders and Cylinder Handling Equipment.

INVEST IN VICTORY **O'FALLON, ILLINOIS** **BUY MORE WAR BONDS**

"PITTSBURGH" DEVELOPMENTS IN AIRPLANE GLASS

Bent Bullet-resisting Glass

THE PROBLEM: To supply a *bent* laminated bullet-resisting glass for use in combat airplanes where flat bullet-resisting panels are undesirable because of critical space or aerodynamic requirements.

THE SOLUTION: Pittsburgh Plate Glass Company developed a new manufacturing technique for the production of its Multiplate Bullet-Resisting Glass in bent shapes. This involved development of all basic data on armor-piercing ammunition as used on both flat and bent bullet-resisting glass, as well as the fundamental data regarding characteristics of glass as a bullet-resisting material.

A long list of developments such as this have made Pittsburgh Plate Glass Company a recognized leader in the field of laminated safety glasses for aviation use. If you would like further technical data on any aspect of the use of safety glass in airplane glazing, we urge you to write us on your letterhead, outlining your particular requirements. Address Pittsburgh Plate Glass Company, 2240-4 Grant Building, Pittsburgh 19, Pennsylvania.

"PITTSBURGH" stands for Quality Glass and Paint

PITTSBURGH PLATE GLASS COMPANY

Specialists in Airplane Glass

MAKERS OF DUPLATE AND FLEXSEAL SAFETY GLASS AND OF MULTIPLATE BULLET-RESISTING GLASS

WHERE CAN I GET SOME REAL TEST DATA ON TODAY'S STEELS ?

If you're working with, specifying, or purchasing today's steels, you've probably been asking yourself that question.

And here's your answer: write today for a free copy of Bethlehem's new book entitled "Properties of Frequently Used Carbon and Alloy Steels." The book's 100 pages are literally crammed with charts, graphs, drawings, and other material based on exhaustive tests involving wartime steels—*today's* steels, including the more popular NE varieties.

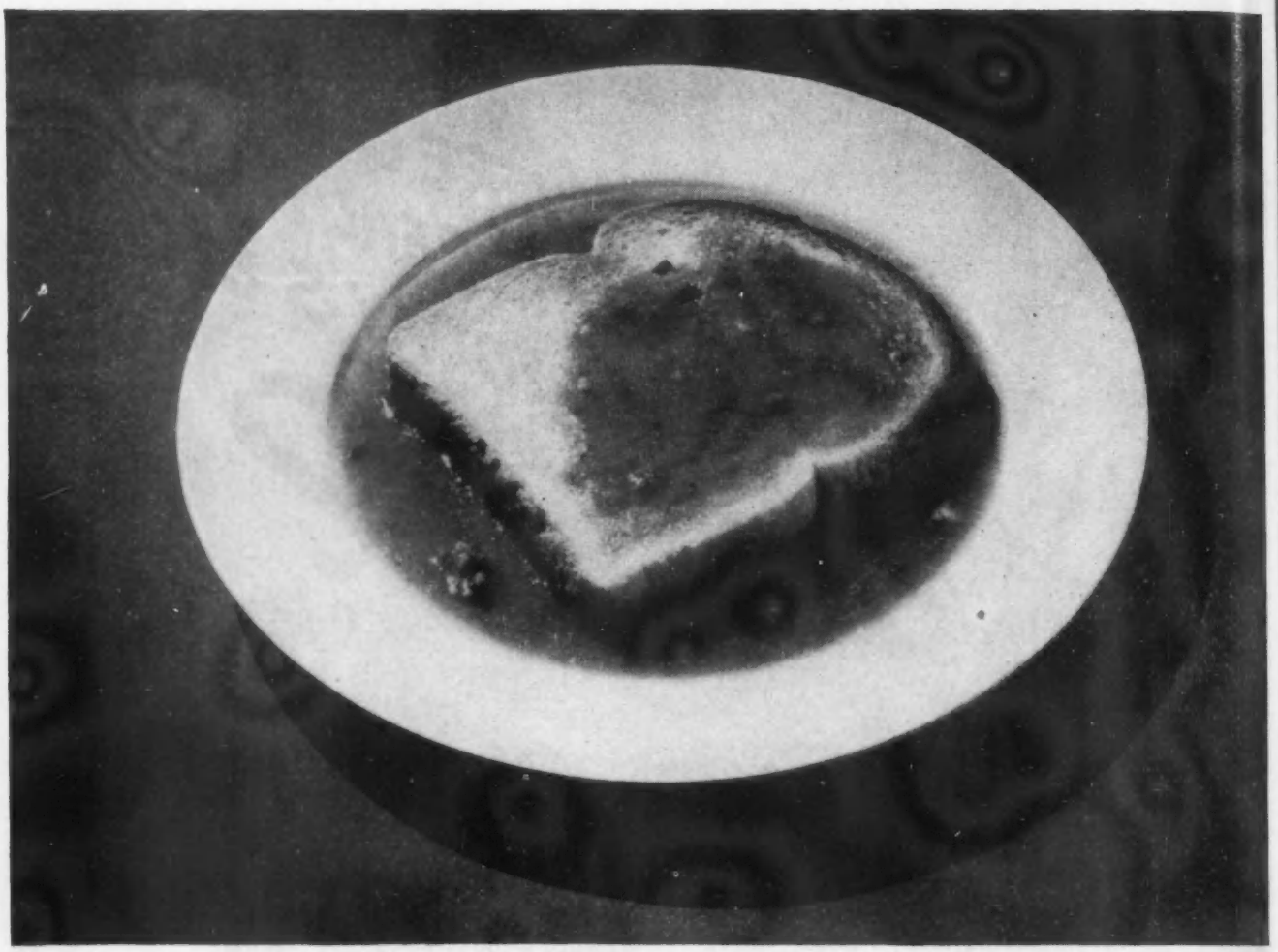
Suppose you want to know the tensile strength or hardness of A 9261 (a silico-manganese-chrome spring steel) after heat-treating, quenching, and drawing at various temperatures. Turn to page 74 of the "Properties" book and you'll find the whole range at a glance. You can spot what you want on the graph in a matter of seconds.

Besides the many pages of charts, tables, etc., the book contains detailed, practical information on such topics as grades of steel, case and core properties of carburized steel, end-quench hardenability, quenching media, and numerous other subjects.

IF YOU USE OR SPECIFY STEEL...

request a copy of this brand-new book. You'll find it of value every day of the week.

BETHLEHEM STEEL



ALL THAT'S SOAKED UP IS NOT GRAVY

PETROLEUM products, for example, may be absorbed by the thousands of resilient parts in a plane—oil seals, hose, accumulator bags, packing, gaskets, grommets, diaphragms—just as gravy is absorbed by bread. This absorption either adds dead weight not included in the original design calculations, or swelling of the liners reduces the capacity of hose, accumulator bags or other similar parts.

Hycar synthetic rubber with its light weight and superb resistance to oil to keep it light, provides protection against increased weight and decreased capacity not offered by any other comparable material. Hycar is 15% to 25% lighter than many other synthetic rubbers and retains this important quality throughout its long life. Oil-swell can be controlled closely to insure dimensional stability of parts.

Hycar has an operating range of −65° to +250° F. and abrasion resistance 50% better than natural rubber. Unlike many other oil-resistant synthetic rubbers, Hycar has a minimum tendency to cold flow after taking the initial deformation, even at elevated temperatures.

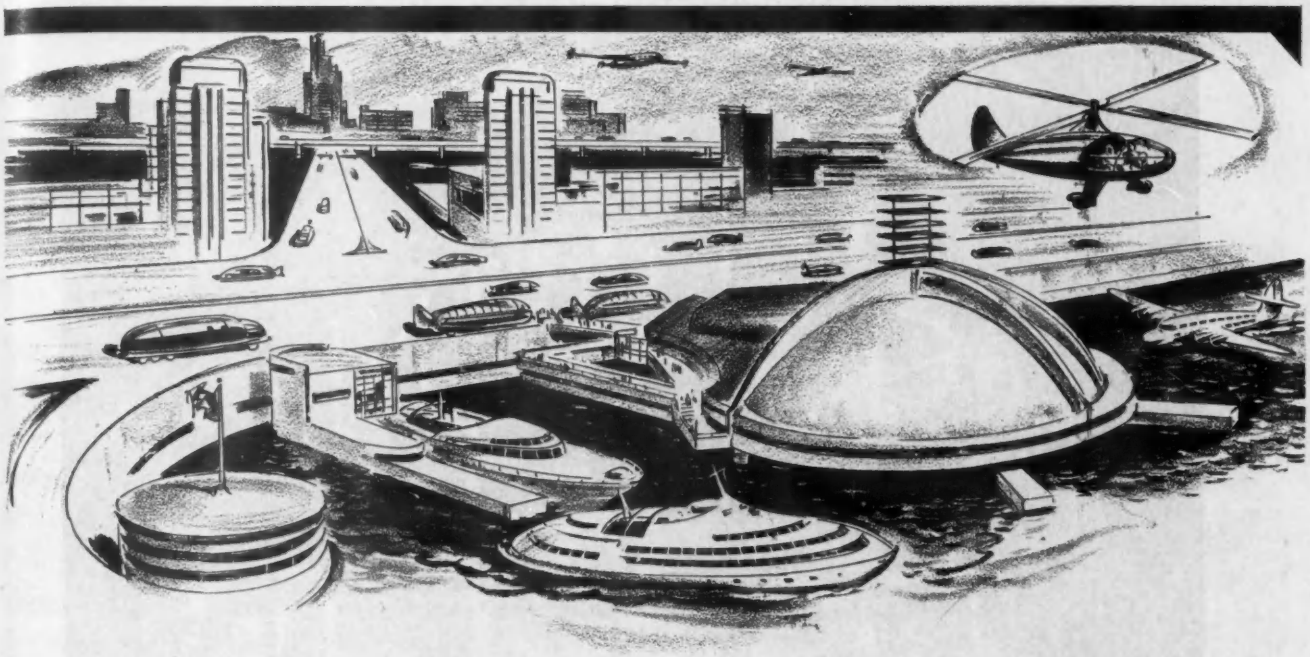
You need these qualities in resilient materials used in the presence of oil and gasoline. Let our technical service staff help solve your individual problems. *Hycar Chemical Company, Akron 8, Ohio.*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubber



PLAN *Now* TO USE PORTABLE POWER!

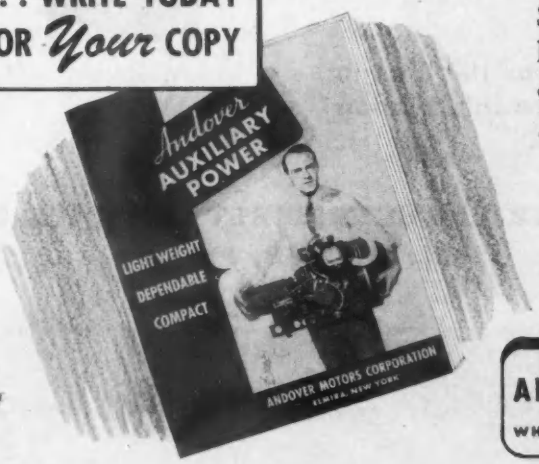
● America is making plans *now* for a great future—a future where the utilization of many vital wartime products will give us a more abundant life when peace is restored.

One of today's "weapons of war"—*the Andover Portable Power Unit*—will revolutionize the operation of much electrical and mechanical driven equipment in industry tomorrow where lightness and portability are desired.

It's not too soon to consider this compact unit for postwar duty in *your* industry. Its versatility of design—light weight, compactness, large power output per pound of weight and dependability—will mean much to you in the peacetime competitive period.

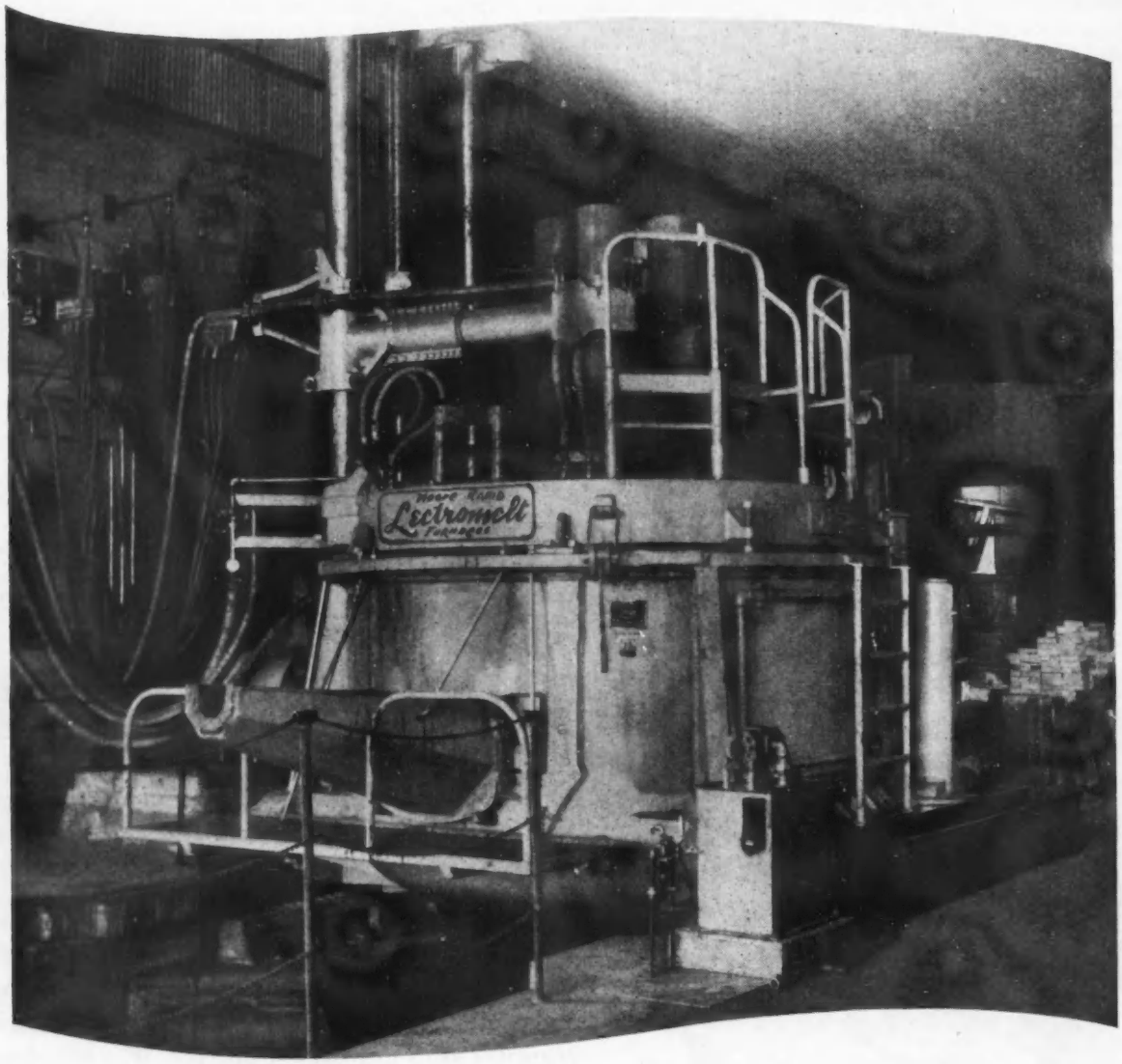
Send for the informative and descriptive booklet "Andover Auxiliary Power" today. It's chock-full of technical data and suggestive uses. No obligation.

. . . WRITE TODAY FOR *Your* COPY



ANDOVER MOTORS CORPORATION • ELMIRA, N. Y.

WHOLLY-OWNED SUBSIDIARY OF ANDOVER KENT AVIATION CORPORATION



Are You Melting *Quality Steels?*

★ Moore Rapid Lectromelt Furnaces of the top charge type will increase your tonnage. Their quick charging features reduce the time between heats and eliminate most of the furnace heat loss during the operation.

Lectromelts are available in sizes from 100 tons to 250 pounds capacity. Write for more information about these faster charging furnaces.

ARMY E NAVY

PITTSBURGH LECTROMELT FURNACE CORP.
PITTSBURGH, PENNA.

MOORE RAPID
Lectromelt
FURNACES

The Furnace of Today and Tomorrow

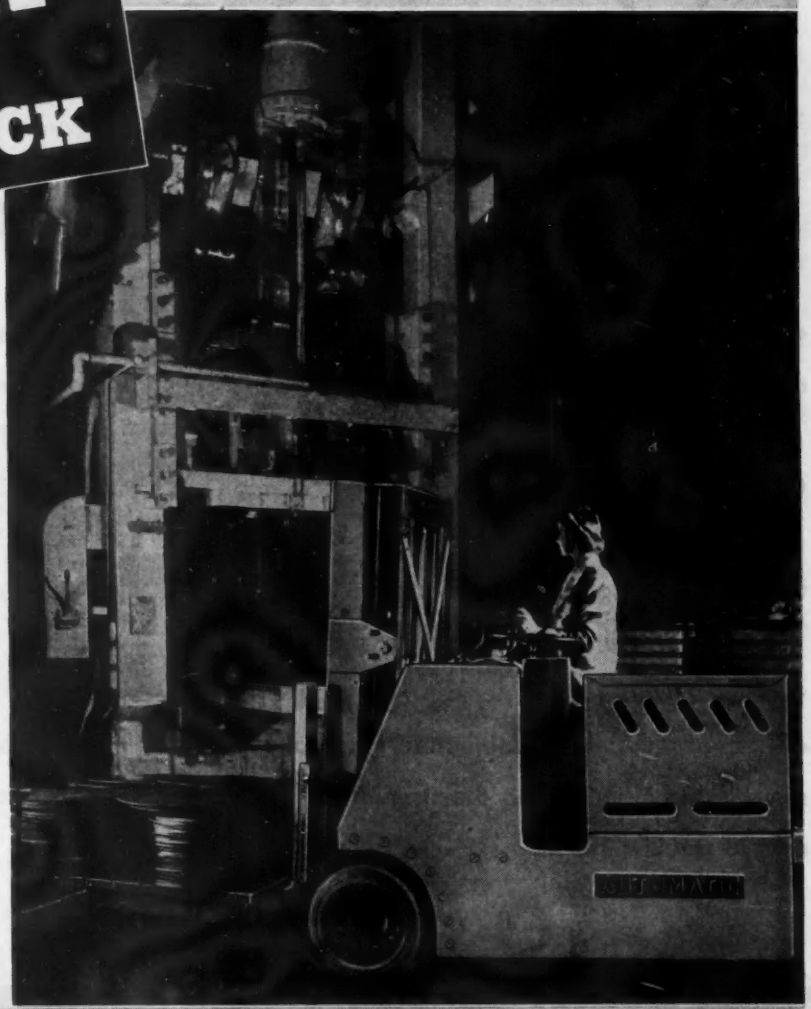
FAST MOVING

MATERIAL HANDLING *System*

FROM RECEIVING THROUGH PROCESS . . .

★ The employment of "AUTOMATIC" Tiering Fork Trucks in handling sheet stock from its arrival through various processes of manufacture is a definite answer to efficiency as well as low costs. Both Pallet Platforms and Skid Boxes are used.

TRADE **AUTOMATIC** MARK
Tiering
FORK TRUCK



Sheet stock is quickly unloaded from the box cars, taken directly to storage and tiered by an "AUTOMATIC" thereby eliminating needless handling and delay. Ceiling space is utilized and high, orderly stacks are quickly and easily accessible.

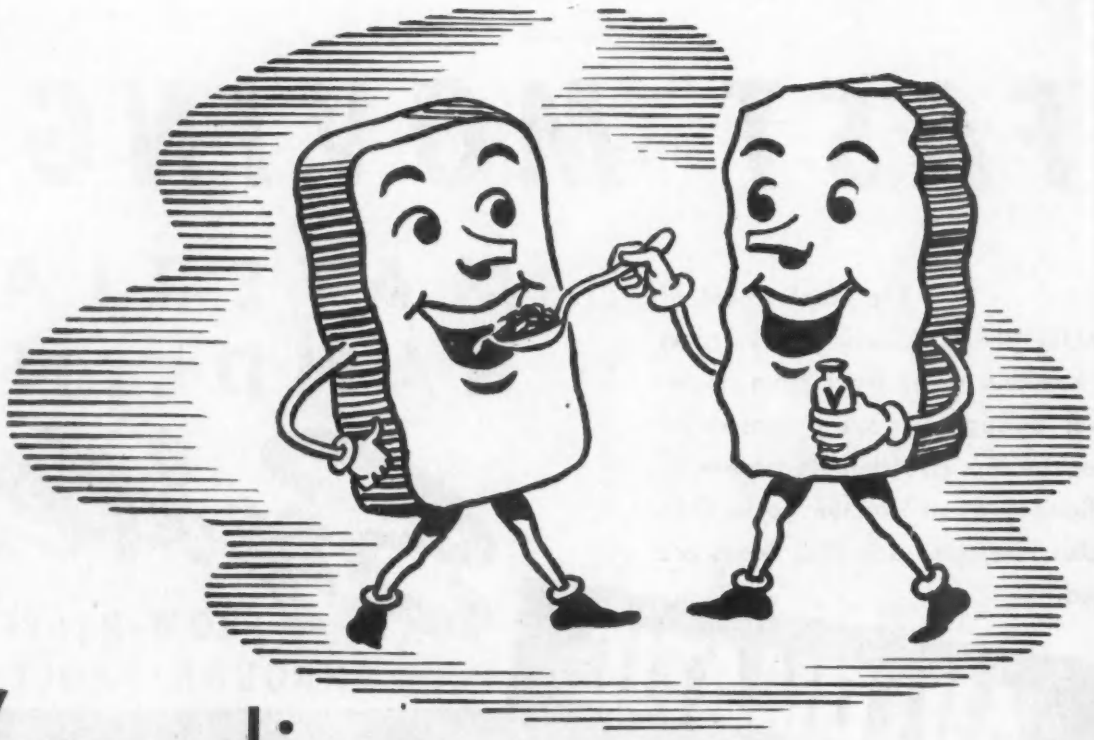
The "AUTOMATIC" illustrated delivers sheet stock to a blanking press, then delivers the discs to the next operation. A continuous flow of work is thus maintained at low cost.

. . . Find out just how you can apply the "AUTOMATIC" Tiering Fork Truck to your handling needs —write today.

MANUFACTURERS FOR OVER THIRTY FIVE YEARS *Electric Propelled* INDUSTRIAL TRUCKS

AUTOMATIC TRANSPORTATION CO.

57 WEST 87th STREET — DIV. OF THE YALE & TOWNE MFG. CO. — CHICAGO 20, ILLINOIS



Vanadium— a Tonic for Steel

● Perhaps you have a difficult specification to meet in cast, forged, or rolled steel...

Perhaps your welds do not meet the specifications for bend tests and freedom from cracking...

Perhaps you need a higher elastic limit or more toughness for higher impact resistance...

If you do, you should try a small percentage of vanadium (0.05 to 0.10 per cent) in your steel. The effects of this slight addition of vanadium are remarkable in increasing the strength and toughness of steel.

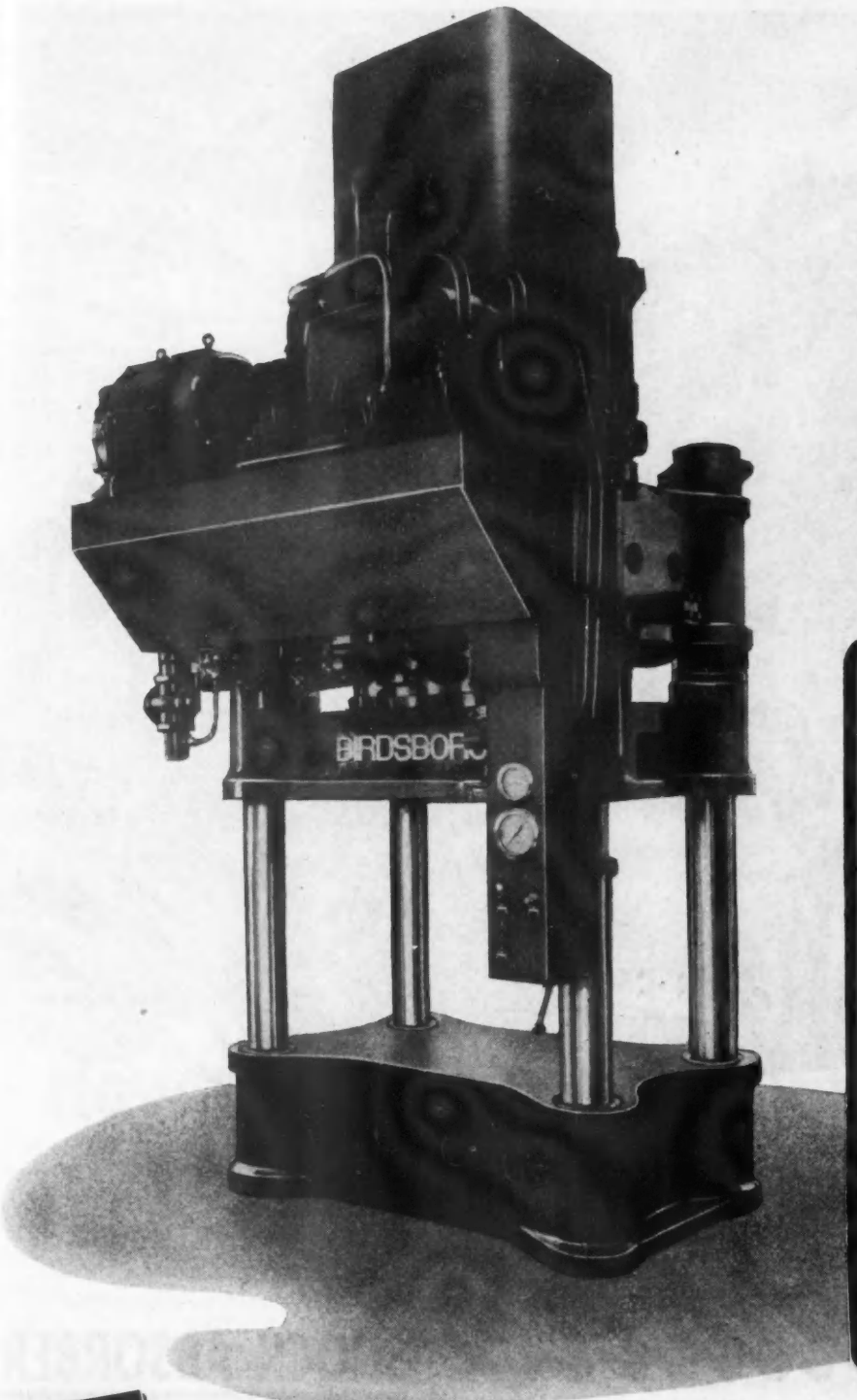
For example: The addition of sufficient vanadium to welding rod coatings to introduce 0.10 per cent into the weld metal has increased the tensile strength of the welds several thousand pounds per square inch without lowering the ductility.

You can get more information about the use of vanadium for improved physical properties of steel by writing for the booklet "Vanadium in Steel and Iron—A Review" or by getting in touch with the metallurgical engineer at your nearest Electromet office.

BUY UNITED STATES WAR BONDS AND STAMPS

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet
Trade Mark
Ferro-Alloys & Metals



• Birdsboro engineers are constantly improving the designs of Birdsboro high speed presses to make them produce more parts per hour . . . to make them safer, easier to use . . . to make them cost less to maintain. The aircraft and allied metal-working industries are making full use of our engineering products and services. We will be glad to put this experience to work on your next hydraulic press problem.

•

Illustration shows a Birdsboro 750 ton Hydraulic Metal Working Press. This type press is available in sizes from 150 ton to 5500 ton.

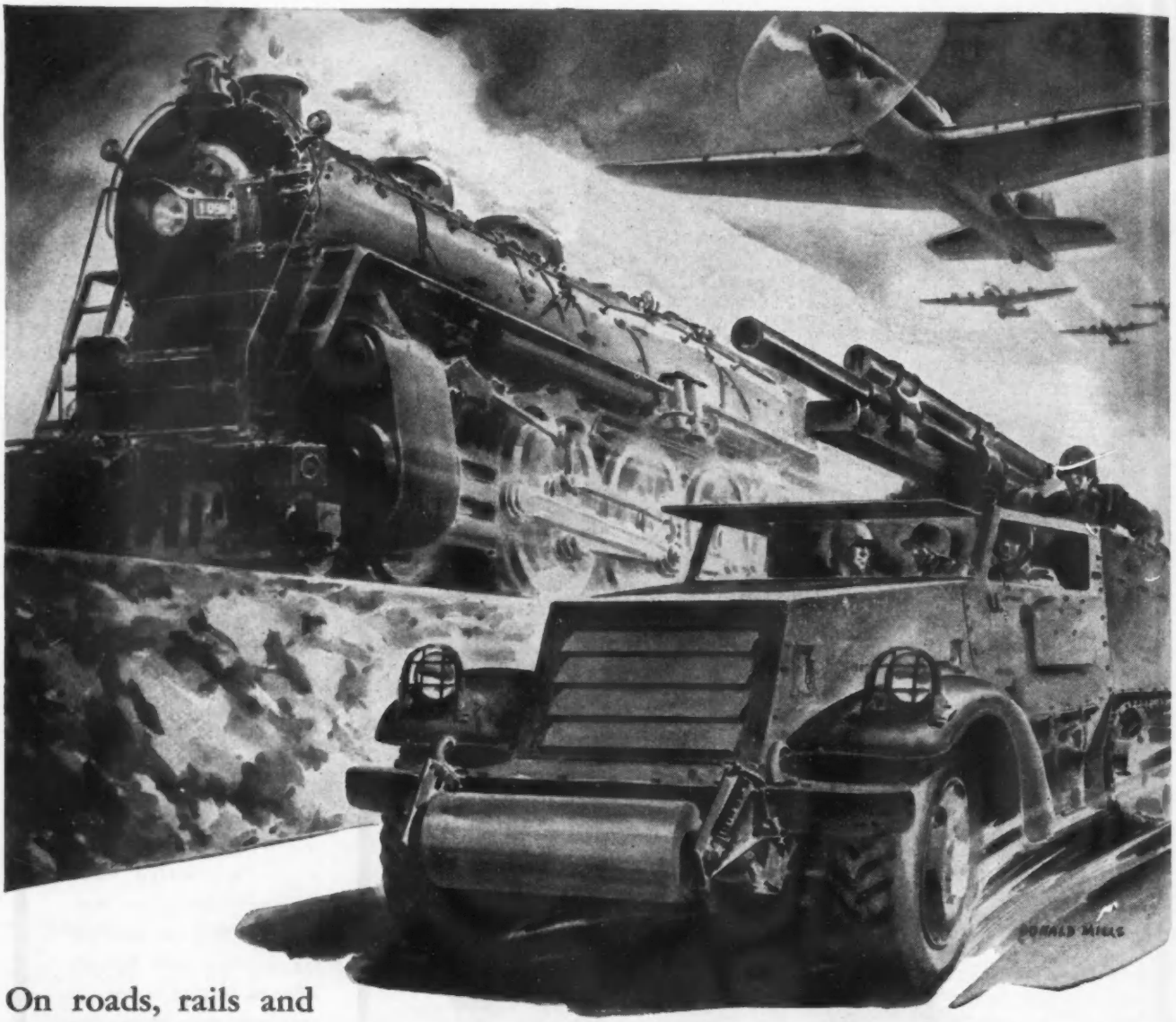
For additional information write for the Birdsboro Hydraulic Metal Working Press Catalogue.

BUY WAR BONDS

Birdsboro Steel Foundry and Machine Company, Birdsboro, Pa.

BIRDSBORO

HYDRAULIC PLASTIC PRESSES



On roads, rails and
in the sky—in every
land—in every language . . .

Houdaille* means "SHOCK ABSORBER"

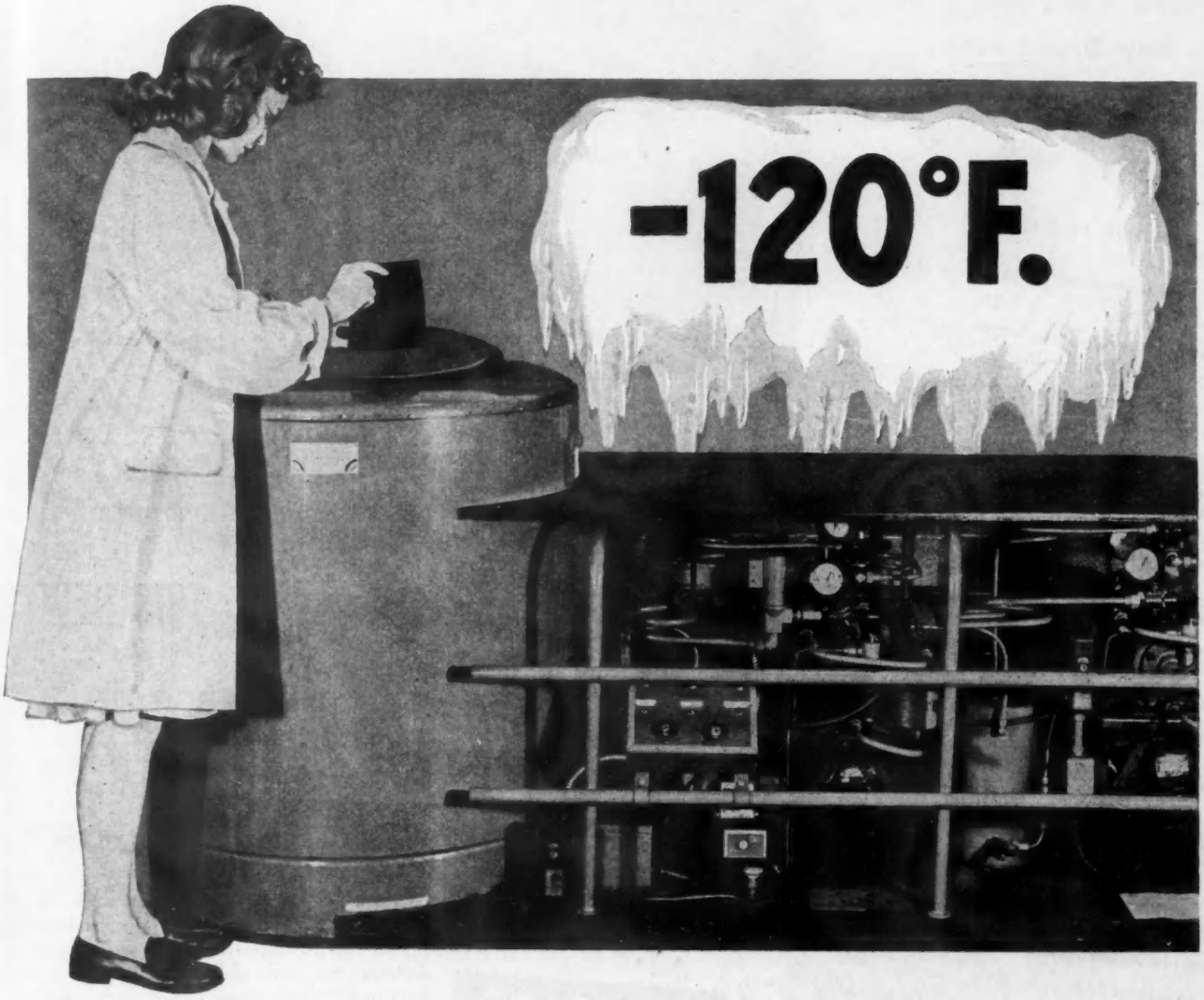
Under the positive, dependable and gentle control of soundly engineered and finely built Houdaille Hydraulic Devices, the violent thrusts, vibrations and shocks, to which mechanisms of transportation are subjected, cease to be a hazard or a discomfort.

There is no comparable engineering substitute for the Houdaille Hydraulic shock absorption principle —*that* fact has been dramatically confirmed under present war conditions. And it is inevitable that new and far-reaching Houdaille adaptations of this basically sound principle will increasingly smooth the paths of civilization in the days ahead.

HOUDE ENGINEERING DIVISION OF
HOUDAILLE-HERSHEY CORPORATION
Makers of Hydraulic Controls
BUFFALO 11, NEW YORK

BUY U. S. WAR BONDS

**Pronounced "HOO-DYE"*



How Much Cold Can Rubber Stand?

Sub-zero temperatures as low as —120° F. are produced by the machine illustrated. It is a **Deepfreeze** *"Cascade Unit"* manufactured by the Deepfreeze Division of the Motor Products Corporation of North Chicago, Ill.

This modern testing machine is used by The Ohio Rubber Company to predetermine the cold resistance of every rubber and synthetic rubber compound formulated to meet specifications for parts to be subjected to sub-zero temperatures.

Unless properly compounded to resist extreme cold, soft rubber or synthetic rubber can become as hard and brittle as glass, and as easily shattered. Such failures are prevented at "Ohio Rubber" by the use of the machine illustrated.

This is but one of many types of modern testing equipment used by "ORCO" technicians to meet exacting specifications for mechanical molded and extruded rubber parts including special processes for bonding rubber and synthetic rubber to metals and other materials.

Refer *YOUR* specifications to *"ORCO"* for thorough and economical production.

"ORCO-OPERATION"

THE OHIO RUBBER COMPANY · WILLOUGHBY, OHIO

BRANCHES: DETROIT · NEW YORK · CHICAGO · INDIANAPOLIS · WASHINGTON · CLEVELAND

Here's a Complete Index of What You'll Find in this New Deepfreeze Cold Treating "Textbook"

SECTION I—INDUSTRIAL COLD TREATING AND HOW IT IS USED

How Deepfreeze Assisted in the Development of Cold Treating.
How Deepfreeze Sub-Zero Temperatures Can Be Applied to Your Production.
What the New Deepfreeze Process of Cold Treating Is.

SECTION II—DEEPFREEZE SUB-ZERO CHILLING EQUIPMENT

SECTION III—HARDENING OF METALS

What Happens When Metal Is Cold Treated?
At What Temperatures Must Metal Be Cold Treated?
How Long Does It Take to Cold Treat Metal?
Procedure in Calculating the Rate of Production.
Common Cold Treating Procedures.

SECTION IV—STABILIZATION OF METALS

Stabilization of Metals by Cold Treating.
Stabilization Procedures.
Results of Stabilizing Gauges and Precision Machine Parts.

SECTION V—SHRINKING OF METALS

Shrinking of Metals by Cold Treating.
Advantages of Chilling for Shrink-Fit Assembly.
Procedure in Shrinking Metal.
Results of Shrink-Fit Assembly by Cold Treating.

SECTION VI—TESTING AND MISCELLANEOUS APPLICATIONS

Testing of Aircraft Instruments and Materials at Sub-Zero Temperatures.
Miscellaneous Applications.

SECTION VII—TECHNICAL DATA AND TABLES

Table for Conversion from Degrees Centigrade to Degrees Fahrenheit.
Shrink-Fit Tolerance Table.
Shrink-Fit Allowance Table.
List of Deepfreeze Users.
How to Use the Deepfreeze Technical Service.

THIS NEW 194

Deepfreeze

COLD TREATING "TEXTBOOK"

● To bring you up-to-date on cold treating, Deepfreeze has just released a new "Cold Treating Practice" manual containing the latest authentic information on the use of sub-zero temperatures for the hardening, stabilization, shrinking, and testing of metals and other materials. This 40-page "textbook" contains the latest developments and practices finding widespread use today in the cold treatment of metals.

This Free Book Will Show You How to Get the Advantages of Cold Treating in Your Plant

Whether or not you are using sub-zero temperatures in your plant at present, you will be interested in the new procedures that have been developed. If you are now cold treating, you will be able to check your applications against those listed—and many of these have been discovered only recently—to determine whether you are using it to full advantage.

Cold treating is on the move. Yesterday's literature no longer tells the complete story. The rapid progress made in this field since the publication of the first Deepfreeze Cold Treating Manual late in 1943 is of extreme importance to industrial users. To bring you the latest information, Deepfreeze presents this new working guide on the use of sub-zero temperatures.

Contains Latest Authentic Data from Metallurgists, Production Men and Deepfreeze Users

This book reflects our pioneering experiences in the science of cold treating and the sound practical knowledge we have accumulated from metallurgists, heat treating experts, production men and Deepfreeze users. The material for this manual has been gathered by our staff of field engineers constantly reporting the applications of Deepfreeze sub-zero temperatures in industry.

Deepfreeze
2314 Davis Street, North Chicago, Illinois

Please send.....copies of the new 1944 Deepfreeze "Cold Treating Practice" book to:

Name.....

Title.....

Firm.....

City.....State.....

Send coupon today for your free copies

Every executive and production man concerned with the "conditioning" of metals should have a copy of this new book. Send the coupon today for the number of copies you need for your key men.

"Only Motor Products Can Make a DEEPFREEZE"

Deepfreeze

TRADE MARK DEEPFREEZE REGISTERED UNITED STATES PATENT OFFICE
Industrial Chilling Equipment for Shrinking, Testing, Hardening and Stabilizing Metals

2314 DAVIS STREET
NORTH CHICAGO, ILLINOIS

Division of Motor Products Corporation, Detroit, Michigan

DISSTON

provides

STANDARD ALLOY STEEL

of aircraft quality
FOR AIRPLANE PARTS

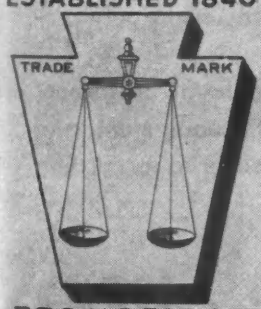
of gun quality
FOR GUN BARRELS,
RIFLE AND TORPEDO PARTS

Produced by modern steel practice in electric furnaces . . . from carefully selected materials, under expert supervision and precise control.

POSTWAR NOTE....

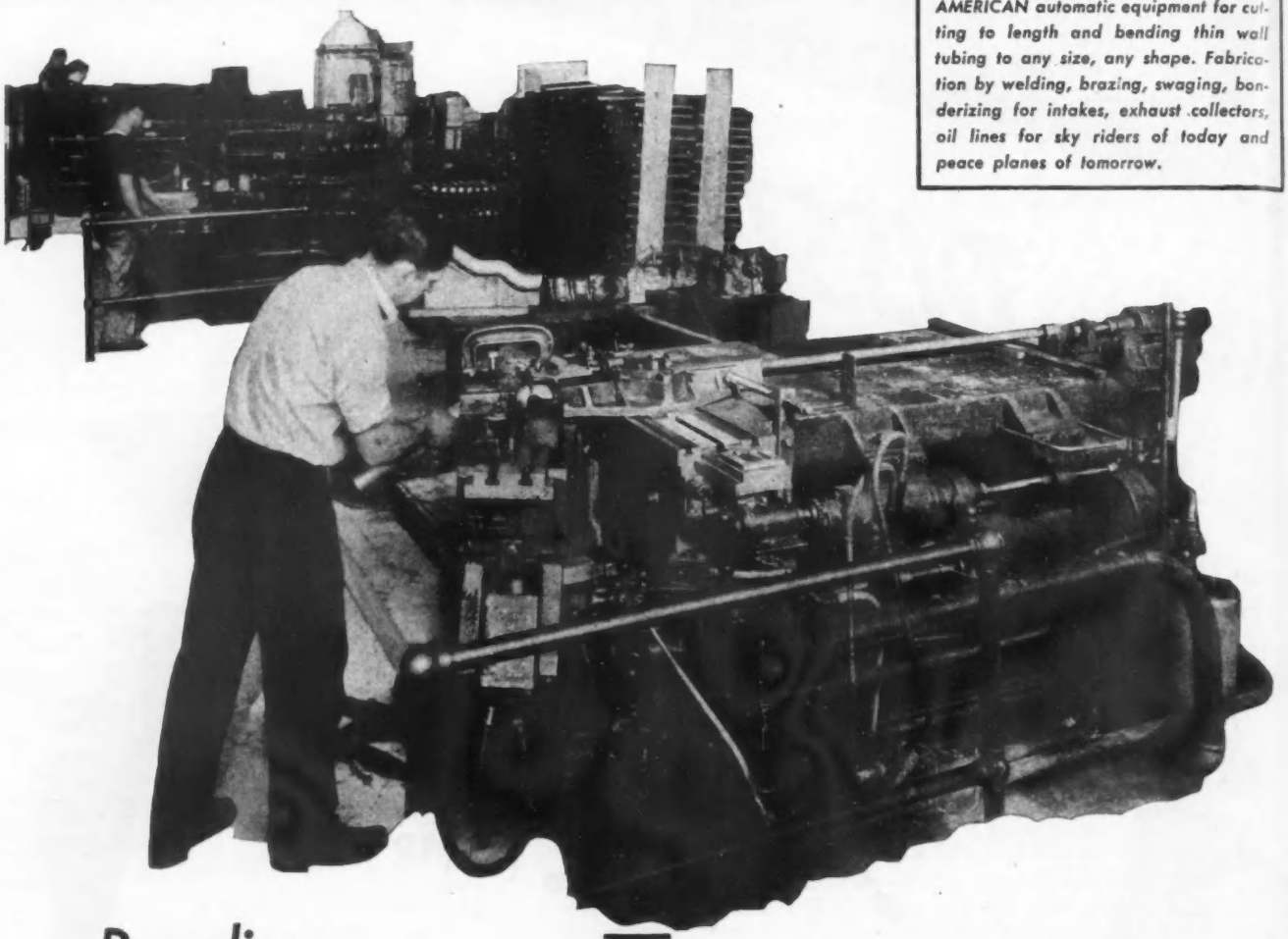
Important possibilities for the use of Fine Tool Steels in postwar production are apparent to many planners. Disston metallurgists and engineers are glad to put their wide experience in the production of quality alloy and carbon steels at your service. Consult them for advice and co-operation without obligation. Write fully.

ESTABLISHED 1840



REG. U.S. PAT. OFF.

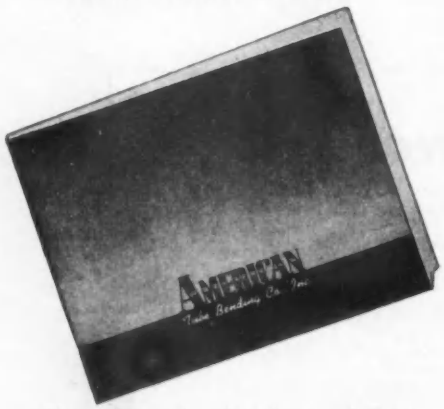
HENRY DISSTON & SONS, INC., 831 Tacony, Philadelphia 35, Pa., U. S. A.



AMERICAN automatic equipment for cutting to length and bending thin wall tubing to any size, any shape. Fabrication by welding, brazing, swaging, bonderizing for intakes, exhaust collectors, oil lines for sky riders of today and peace planes of tomorrow.

Bending Intakes at AMERICAN

FREE — DATA BOOK



This informative Catalog and Data Book gladly sent on request.

WHERE ONE MILE PER HOUR SHOP SPEED = 500 MILES PER HOUR SKY SPEED

Since 1910 this company has specialized on *precision bending* for the automotive and aviation trade. Then, there were no specially built machines, no established standards, no tightly drawn AN specifications. Today, operations are automatic, jig and fixture fits, micrometer accuracies, largely pioneered by American.

At your service are a thousand loyal craftsmen, keen native ingenuity, automatic equipment and good management to insure deliveries according to schedule.

AMERICAN TUBE·BENDING CO., INC.

7 Lawrence Street, New Haven 11, Conn.

"MICROMETER CONSCIOUS"

in the quantity production of minute precision parts

Forty-five manufacturers of major prominence now are relying upon the micrometer-conscious Wadsworth Small Parts Division for scores of parts so minute and precise that their quantity production is difficult or expensive for the average plant.

At Wadsworth, such production is customary, and meets the highest critical standards.

Here, a unique machine setup and workers who *think* precision are intimately associated under one roof. They contribute special operations to many pieces and carry others through in their entirety, in great quantities.

We welcome conversations with all companies who intend to be postwar factors in their fields and will be glad to discuss the matter of applying Wadsworth skills to your special needs.

WADSWORTH FACILITIES

Die Making
Jigs & Fixtures
Gage Making
Model Building
Milling
Drilling
Turning
Stamping
Screw Machining
Hard Soldering
Heat Treating
Line Assembly
Polishing
Lacquering
Photo-Etching
Silk Screening
Product Decorating
Metals Laboratory
Engineering Design
Product Design

CURRENTLY SERVING THESE INDUSTRIES

Aircraft
Automotive
Bearing
Electronics
Instruments
Machine Tool
Small Arms
Refrigeration

SMALL PARTS DIVISION

THE *Wadsworth* WATCH CASE CO., Inc.

DAYTON, KENTUCKY, SUBURB OF CINCINNATI, OHIO

PHONE COLONIAL 8194 • (CINCINNATI EXCHANGE)

Wadsworth is heavily engaged in many-sided war work. But our steady production of Military Watch Cases and our constant designing of the precious metal cases for the future are preserving the art of fine watch case development.

YOURS FOR THE..... *Asking!*

A BIG 24-PAGE STOCK LIST

To aid you in locating tools now in stock—ready for immediate delivery . . . this big book listing standard production tools is yours for the asking. It is no longer necessary to wait or substitute . . . check this list and find the tools you want. All tools listed are subject to prior sale so act quickly.

JUST CLIP AND MAIL *Now!*

Kindly send a copy of your new "Tools on the Shelf" Stock List to

Mr. _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

☐ Put my name on your regular mailing list to receive succeeding issues.

☐ We do not have your 384 page Tool Engineering Manual 500.

Scully-Jones
AND COMPANY

1901 SOUTH ROCKWELL STREET ★ CHICAGO, U. S. A.

WHERE "A CHIP OFF THE OLD BLOCK" ASSURES QUALITY

Pardon us, it isn't a chip at all. But we use the phrase because it helps us to convey to you the idea that from every heat poured, a sample of metal is ladled out and sent to our laboratories for analysis—to make sure that it conforms to the specifications.

This procedure is one of the first in a succession of steps taken in our endeavor to control quality "from ore to finished product."

Another important step (also taken *before* the base size tube is made, to assure your getting tube that will meet the highest standard) is the scalping of each block, a process which removes the "skin" to permit a careful inspection of the block and make certain that no imperfections find their way into the extruder and finally into the finished tube.

You are always sure of uniform quality in non-ferrous tubing when you specify Wolverine.

BUY WAR BONDS

WOLVERINE

TUBE DIVISION

CALUMET & HECLA CONSOLIDATED COPPER COMPANY

1417 CENTRAL AVENUE • DETROIT 9, MICHIGAN

In Canada: UNIFIN TUBE CO., LONDON, ONT.

DO YOUR POST-WAR PLANS CALL FOR PRECISION PARTS ?

THIS ADECO GUIDE-BOOK CAN HELP YOU . . . SEND FOR IT TODAY

Get this new illustrated booklet and see how the Adeco organization and facilities can meet your exact specifications for close-tolerance production of parts and assemblies on a contract basis. This helpful information is yours for the asking.

ADECO

AIRCRAFT & DIESEL EQUIPMENT CORP.
4401 N. RAVENSWOOD AVE.
CHICAGO 40, ILLINOIS
Your Partners in Precision

BOOKS . . . .

SUGGESTED SHOP PROBLEMS FOR HAND SKILL PRACTICE, by *I. D. White*, is a timely and practical shop manual for practice in aircraft and specialized sheet metal work. It contains 60 easy-to-make projects with 78 blue prints. There are 104 printed pages consisting of six distinctive groups of simple procedures for hand skill practice.

The book is abundant with shop ideas useful for defense contract jobs, in working up sheet metal boxes and various other parts, for aircraft maintenance, sheet metal replacement parts, also for machine shop bench hand work on small hand working fixtures. Over 100 hand tools, bench machines and floor machines are illustrated. There is much useful data on blue print reading, sheet metal drafting, layouts, pattern making, precision hand filing, assembly, and riveting. Published by *The Metal Crafts Guild, P. O. Box 142, Flatbush Sta., Brooklyn, N. Y.*

AEROSPHERE 1943, by *Glenn D. Angle*, is intended to cover the more important spheres of activity in the field of aviation throughout the world; in particular, to describe the aircraft and engines produced, and list the names of the various firms which are engaged in their operation, or the manufacture of materials or parts going into their fabrication and use. This volume, then, is intended to serve as a convenient and authentic reference work for everyone engaged or interested in aviation.

AEROSPHERE 1943 is published and distributed by *Aerosphere, Inc., 370 Lexington Ave., New York, N. Y.*

Personals

(Continued from page 58)

neer. He will make his headquarters in the companys Detroit office.

Errol J. Gay, manager of the bus, truck and fleet division of Ethyl Corp., has been awarded the emblem for Meritorious Civilian Service by the Army for overseas achievement as a technical civilian advisor on petroleum problems.

Alfred D. Edgerton, resident patent counsel for the White Motor Co., has been promoted to secretary of the engineering dept., in addition to his duties as patent counsel.

Barber-Colman Co. has announced the appointment of **Roy H. Jones** as direct representative for its line of hobs, milling cutters and reamers in Los Angeles.

Thermoid Co. has announced the appointment of **Albert Grindy** as comptroller of the company and its subsidiaries.

J. F. Wolfram has been named chief engineer of Oldsmobile Div. of General Motors. He succeeds **H. T. Youngren,** who has resigned.

Kellogg Switchboard & Supply Co. has announced the appointment of **F. M. Parsons** as sales manager and **C. D. Manning** as executive assistant to the president.

Wickwire Spencer Steel Co. has announced the promotion of **R. T. Dunlap** to the position of vice-president in charge of production. **A. G. Bussmann** has been made assistant to the president.

Littlefuse, Inc., has appointed **Dee Breen** Western Div. salesmanager, with headquarters at El Monte, California.

Myron B. Gordon has resigned as vice-president and general manager of Wright Aeronautical Corp., Paterson. **G. M. Williams,** senior vice-president of the Curtiss-Wright Corp., will succeed Mr. Gordon.

American Brake Shoe Co. has announced the appointment of **Frank P. Biggs** as vice-president in charge of sales of the Brake Shoe and Castings Div. and the Southern Wheel Division, with offices in New York.

A HEAD START is mighty ESSENTIAL--

Whether it be on the athletic field of today-

or the business field of tomorrow

WE CAN HELP YOU GET A HEAD START ON POSTWAR MARKETS because---

We are specialists in every phase of screw machine parts manufacture and RECONVERSION in our plant is a simple process.

PLAN YOUR POSTWAR PRODUCTS WITH PARTS *from*

U•S•AUTOMATIC
CORPORATION
Screw Machine Products
AMHERST • OHIO

U.S. AUTOMATIC

Chicago Detroit New York

Can **YOUR** *postwar product adapt this wartime ingenuity*

"PACKAGED METAL ENGINEERING*"

- ✓ CUTS PRODUCTION AND ASSEMBLY COSTS ON PARTS AND PRODUCTS
- ✓ SAVES MATERIALS AND WEIGHT
- ✓ IMPROVES UTILITY AND APPEARANCE

When planning your postwar production consider adapting GRAMMES *controlled precision fabrication, synchronized mass production processes, and cleverly devised conveyor assemblying methods* . . . masterfully exemplified in this Adapter Grenade with its series of metal stampings, wire formings and tubing ingeniously welded together and fastened with special drive screws.

With 69 years of precision fabricating skills, cleverly devised assembly methods, and broad "know-how," Grammes can save you time, money and materials on your parts or product. The facilities listed provided a *centralized* set-up for efficient and economical precision fabricating and assembling.

STAMPING	ETCHING	LINE ASSEMBLY	DRILLING
DRAWING	TOOLS & DIES	MACHINING	WELDING
SPINNING	EMBOSSING	SPRAYING	PLATING
WIRE FORMING	LITHOGRAPHING	HARD ENAMELING	
ENAMELING	SCREW MACHINES	HEAT TREATING	

Grammes can be your *complete* manufacturing source, providing the all-inclusive services and facilities of "Packaged Metal Engineering"—**in one package . . . one service . . . we take over* ALL *responsibility, acting as* YOUR *factory, from Design Research to Drop Shipments.*

From idea development and product improvement to postwar manufacture, Grammes Contract Service facilities are available NOW for Research, Design, and Engineering. Let us work with you, complete confidence assured. Send today for our booklet—"Contract Service by Grammes"—address Dept. 11-7.

"MASTER CRAFTSMEN IN METAL"

Grammes

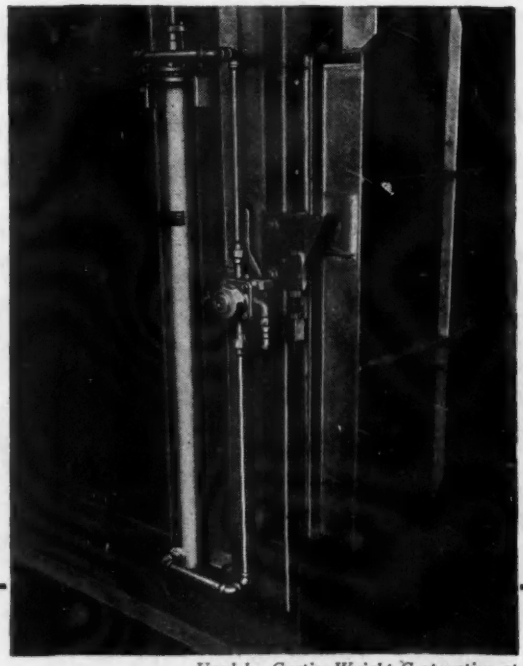
L. F. GRAMMES & SONS, INC., ALLENTOWN, PA.

ESTABLISHED 1875

NEW YORK CHICAGO DETROIT CLEVELAND MILWAUKEE PHILADELPHIA

Oldsmobile CHEVROLET Mack

ALSO CREATORS OF DECORATED NAME PLATES • TRIMS • BEZELS • ESCUTCHEONS



Used by Curtiss-Wright Corporation at Buffalo and St. Louis plants.

CURTIS AIR CYLINDERS

Improve Production, Save Man-Power, Lower Production Costs

It's often a simple matter to powerize a hand operation with a Curtis Air Cylinder and not only increase production efficiency, but save labor, lower costs, and release men for other jobs, too.

Illustrated above is a Curtis Air Cylinder used to operate an oven door at the Buffalo plant of Curtiss-Wright Corporation— only one of hundreds of lifting, pulling, or pushing operations that can be handled by this equipment.

Curtis Air Cylinders have a record of unfailing service in many industries due to their rugged construction and simplicity of design; they are easily operated by women employes. Installation cost is small and power consumption low, using regular shop air lines. Because of their efficiency, negligible maintenance expense, and long life, important savings are almost inevitable wherever Curtis Air Operated Cylinders or Hoists are used.

Why not check your plant to see where Curtis Air Power can be used to advantage? Our free booklet, "How Air Is Being Used in Your Industry," will give valuable suggestions. Send for it today.

CURTIS

ST. LOUIS • NEW YORK • CHICAGO • SAN FRANCISCO • PORTLAND

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1917 Kienlen Avenue, St. Louis, Missouri

● Please send me booklet, "How Air Is Being Used in Your Industry."

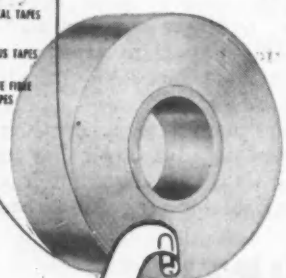
Name.....
Firm.....
Street.....
City.....State.....

TRANSPARENT TAPES
SINGLE AND MULTI-COLORED TAPES
MASKING TAPES
PRINTED TAPES
CUSHIONED RIVETING TAPES
IDENTIFYING TAPES
ELECTRICAL TAPES
LUMINOUS TAPES
ACETATE FIBRE TAPES

Something new in pressure sealing tapes. Filmonize printed tape in a complete color range, one, two or three colors *on one roll*—now used in war plants for identification because the colors won't fade and the printing can't rub off—for labeling and sealing in one operation because that saves time and production cost — in place of decals because Filmonize goes on ten times faster than decals and lasts forever. Place a trial order with your distributor and let your experience prove, *you've never had as good a tape.*

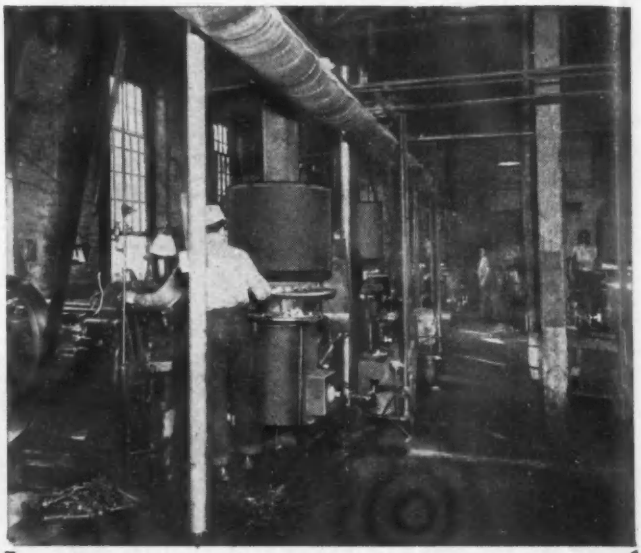
Filmonize Sets New Standards

- Easy to use . . . strips cleanly off the roll.
- No "curl-back" . . . no tangle . . . no waste.
- Fade-proof colors . . . printing sealed in.
- Widths from ½" to 18" throughout the Filmonize line.



Filmonize
TRADE MARK REG.
SELF-SEALING TAPES

INTERNATIONAL PLASTIC CORPORATION MORRISTOWN, N. J.



SPECIAL BOLTS
HEADS FORGED TO SPECIFICATIONS

RITCO Bolts of all types and sizes up to 2" diameter with forged heads are accurately made to your specifications. Our batteries of rotary furnaces, built and patented by RITCO with over a century's bolt-making experience, are at your service. Let us know your requirements.

SPECIAL BOLTS, NUTS AND STUDS
DROP FORGING & DIE SINKING
SCREW MACHINE PRODUCTS
HEAT TREATING
SPRAYED METAL SERVICE
PARKERIZING

We will gladly quote on your specifications.
Catalog on Request

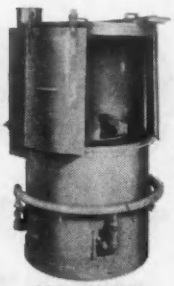
RITCO

RHODE ISLAND TOOL COMPANY
148 West River St., Providence 1, Rhode Island
Serving American Industry Since 1834

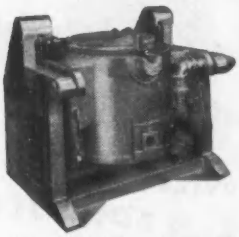
Fisher FURNACES

for PERMANENT MOLD and DIE CASTING

BRASS OR ALUMINUM Semi or Full Muffle Crucible Furnaces.



ALUMINUM, MAGNESIUM, ZINC, ETC. Pot Furnaces with fume hood and Sulphur Dome for Magnesium. Similar design for remelting.



MELT-DOWN FURNACES For hot charging holding furnaces. Motorized and hand tilting.

Fisher Furnaces for Permanent Mold and Die Casting are especially designed for rapid melting and accurate control of metal temperature. Heating characteristics are Fisher Engineered for maximum fuel economy and maximum heat exposure to operators at molds and machines.

These Fisher Furnaces are being supplied complete with pyrometers, thermocouples and motorized valves as a unit ready for installation. Manufacturers of die casting machines and permanent mold castings have proven the advantages of these Fisher coordinated melting units.

Send us details of your requirements for recommendations and quotations.

Ask for this New Condensed Furnace Catalog

5525 NORTH WOLCOTT AVENUE, CHICAGO 40, ILLINOIS

Fisher FURNACE COMPANY

Engineers and Manufacturers

LIFT TRUCKS, INC.

Proved before and during war—ready, now, for application to any "under-roof" load lifting and moving requirements. Illustrated is the HYDRO-LECTRIC Motorized hand lift truck *—weighing only one-third, costing only one-third as much as other "rider" types of electric trucks.* The Hydrolectric is the engineering creation of Walter C. Stuebing, pioneer in lift truck engineering and manufacturing.

Send today for file-size catalogue of the Hydrolectric and other standard type lift trucks.

LIFT TRUCKS INC. ★ STUEBING ★ CINCINNATI

2425 SPRING GROVE AVENUE
CINCINNATI 14, OHIO

VERSATILITY in PRECISION PLASTICS

PICTURED HERE are but 41 of hundreds of precision plastic parts that Standard Molding regularly produces for a myriad urgent needs.

Some of these are so unusual in design, so unique in purpose and exacting in requirements, as to demand engineering ability of the highest order.

Whatever the need, if it's possible in injection molded plastics, Standard Molding is equipped with both the manufacturing skill and engineering ability to execute the job with a maximum of speed —at minimum expense. The full benefit of Standard's specialized engineering knowledge is yours for the asking—both on your present and postwar products and problems.

Mail us your blue-prints today for detailed analysis.

THE STANDARD MOLDING CORPORATION

Dayton 1, Ohio

WRITE FOR THIS CATALOG

—on your letterhead, or tear out this coupon and attach it to your stationery today.

Standard Molding Corporation
Dayton 1, Ohio

Please send me a copy of your new Plastics Catalog without charge or obligation.

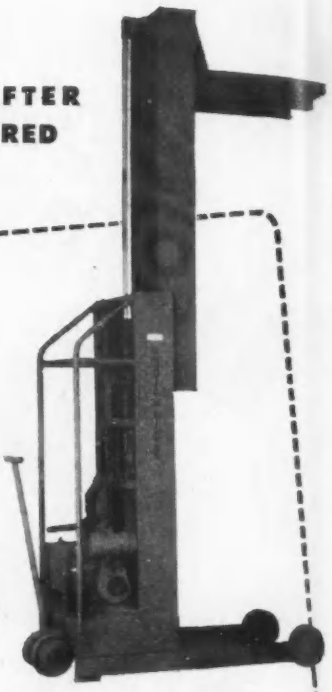
Name_____

Firm Name_____

Address_____

City_____ **Zone**_____ **State**_____

BECAUSE THIS LIFTER IS GASOLINE POWERED



YOU CAN TAKE IT WITH YOU

Anywhere—Anytime

SERVICE GAS-ENGINE HYDRAULIC Lifter

● How many times do your men resort to costly, time-consuming manual lifting—just because power lines don't reach far enough? Those are times when the Service Gas-Engine Lifter will save you time and money. Use it anywhere—this efficient lifter is thoroughly flexible. In addition to giving you the advantages of hydraulic lifting beyond the range of electric lines, the Lifter will prove a mighty valuable piece of equipment in case of electric power failure or temporary shut-off . . . or when you're re-organizing your production lines for postwar operation. Write for complete information today.

VERSATILE
Not limited to range of electric service. With a can of gasoline, you're set to work anywhere.

CAPACITY
Choice of 1,000 or 2,000 lbs. Special capacities and sizes built to order.

TELESCOPIC
Collapsed height 6' 5", Extended height 10' 6", Lift 8' 8".

FAST
Lifting speed 5 to 10 ft. per min., Lowering speed, 15 to 25 ft. per min. loaded.

PLATFORM SIZE
36" x 30".

ENGINE
1½ H.P. Briggs and Stratton.

SAFE
Overload valve.

RUGGED
Built to well-known Service standards of sound construction and quality materials.

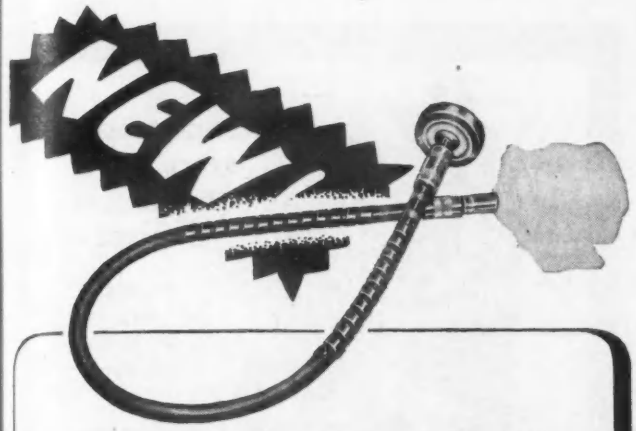
SERVICE CASTER & TRUCK DIVISION
OF DOMESTIC INDUSTRIES, INC.
675 N. Brownswood Ave., Albion, Mich.
Eastern Factory: 420-26 Somerville Ave., Somerville (Boston) Mass.
Toronto, Canada: United Steel Corporation, Ltd., SCAT Co. Division

ARMY E NAVY

SERVICE

DOMESTIC DI INDUSTRIES

Trucks, Casters and Specially Designed Lifting and Hauling Units



..an Easy way to Convert Idle Motors into Modern Tools with

STOW

FLEXIBLE SHAFT

Using the new STOW Flexible Shaft with connection and handpiece, you can quickly convert any old or idle motor into an efficient portable tool for grinding, rotary filing, wire brushing, heavy duty drilling, polishing, etc. The long, light-and-strong Flexible Shaft gives such a unit easy accessibility to several operators without leaving their stations, or permits work at a distance from the bench. Shafts to fit any motor from 1/3 to 3 HP. Great variety of attachments available. Write for information on lengths, sizes, fittings.

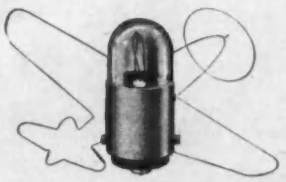
A companion unit, equally useful in any shop, is the Stow Flexible Drill Shaft. Attached to any electric or pneumatic hand drill, it enables the operator to drill true holes *fast* in places where the regular drills can't reach, and relieves him of manipulating heavy or bulky tools.

Write today for catalog or call Stow distributor in your city.

● STOW Flexible Shaft Mobile Units are speeding production in hundreds of war plants, by taking power tools direct to the job — grinding, sanding, drilling, polishing, without moving the piece or assembly.

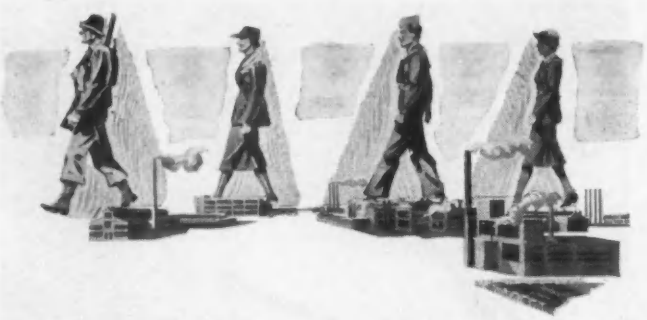
STOW MANUFACTURING CO.
439 Shear St. Binghamton, N. Y.

LIGHT is so essential to aircraft, both when flying and on the ground, that experienced operators use only the most dependable lamps. We are therefore proud that PAN AMERICAN WORLD AIRWAYS use TUNG-SOL Lamps. The care that this airline employs in selecting all equipment makes it a distinction to have our product on a PAN AMERICAN.



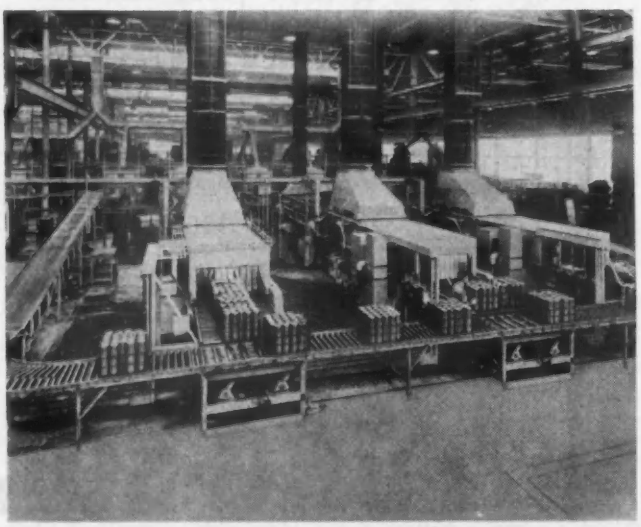
TUNG-SOL
AIRCRAFT LAMPS

TUNG-SOL LAMP WORKS INC., NEWARK 4, N. J., Sales Offices: ATLANTA, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK, PHILADELPHIA.
ALSO MANUFACTURERS OF ELECTRONIC TUBES AND CURRENT INTERMITTORS

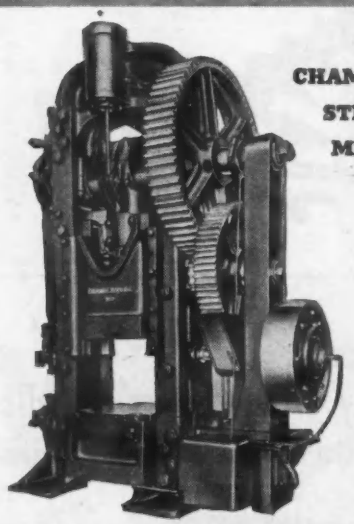


As Manpower Problems grow more acute!

As war production reaches its peak, the manpower situation in industry changes. In most cases the problems are becoming more acute. The demands for men and women for the Armed Forces are heavy. The only recourse, if production is to be maintained, is the use of more women or older men, whenever possible. More than ever, Mathews Engineering is essential. Mathews Gravity and Power Conveyers, and the special devices which make Mathews Systems prominent, are on the job in the great war plants of the United States and Canada, helping to move materials through manufacturing departments with greater control, lower cost, and with a minimum of fatiguing effort on the part of machine operators. They are serving these men and women — helping them to do a better job without unnecessary re-handling of heavy materials. Mathews Engineering service is available in principal cities of the United States and Canada.



Mathews Conveyer Company
ELLWOOD CITY, PENNSYLVANIA



CHAMBERSBURG STEEL SIDE MECHANICAL PRESSES

SINGLE AND DOUBLE CRANK

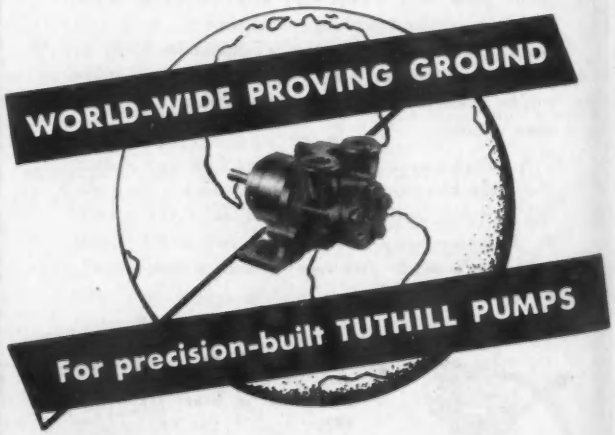
Designed originally for trimming operations in forge shops. However, due to their sturdy construction and their patented Steel Side Frames, they are ideal for all forms of blanking, punching, binding and shaping operations. Easily accessible, front or back, protected by all latest safety devices, these presses have proved themselves in continuous operation, low power consumption and minimum floor space.

Details in Bulletin No. 208-A

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

CHAMBERSBURG

HAMMERS • PRESSES • CECOSTAMPS



Hundreds of thousands of Tuthill Small Pumps in service throughout the world today provide the best evidence of dependable pump performance. Precision manufacture makes these internal gear rotary pumps outstanding for small pump requirements. Sizes from 1 to 200 g.p.m. and pressures up to 400 p.s.i. Available for coolant, lubrication, hydraulic, fuel delivery and liquid transfer service. Write for General Catalog.

★

TUTHILL

SERVING ARMY NAVY • AIR FORCE MERCHANT MARINE

TUTHILL PUMP COMPANY
939 E. 95th ST. • CHICAGO 19, ILLINOIS

WHEN THE "LONGEST WAY 'ROUND IS THE SHORTEST WAY HOME"... Specify Walker-Turner Flexible Shafting

In transmitting light power loads between two points, it is often possible to design a simpler, lighter, more compact product with Flexible Shafting than with gears.

You'll find, too, that it pays to specify Walker-Turner Flexible Shafting on jobs like these — for smoother power flow, more sensitive control, trouble-free operation. Into this product, we've packed all the "know-how" picked up in years of manufacturing our own flexible shaft machines . . . in years of working with other manufacturers on problems of power transmission and remote control. Let us know if we can put that experience to work for you!

WALKER - TURNER COMPANY, INC.
Plainfield • New Jersey

. . . the dependable protection for goods in transit!

IN STEAMING JUNGLE and frigid arctic areas, war supplies protected by FIBREEN are arriving in usable condition despite direct exposure to the elements. The weatherproof, tear-resistant, scuff-proof qualities that made FIBREEN the preferred protection for peacetime goods in transit are the very reasons why it is now an essential war need. When victory is won, FIBREEN will again be available for general use.

Cut Your Postwar Shipping Costs!

Shipping and handling costs in many industries have been reduced by the use of FIBREEN. For nearly 25 years The SISALKRAFT Company has pioneered in methods of using fibre-reenforced, waterproof wrapping materials.

In your postwar planning you may benefit from our long experience in the uses of FIBREEN and other SISALKRAFT products — to protect your products from damage in transit — to cut costs — to reduce losses in transit!

SISALKRAFT leadership is the result of the unmatched performance of its products and a research and engineering service for developing better wrapping methods.

THE SISALKRAFT CO.
205 W. WACKER DRIVE · CHICAGO 6, ILL.
NEW YORK · SAN FRANCISCO · LONDON · SYDNEY

Ask SISALKRAFT *to help cut your wrapping and shipping costs!*

Manufacturers of SISALKRAFT, FIBREEN, SISAL-X, SISALTAPE AND COPPER-ARMORED SISALKRAFT

ANOTHER SPECIAL BY PROGRESSIVE

QUALITY PROMCO BRAND

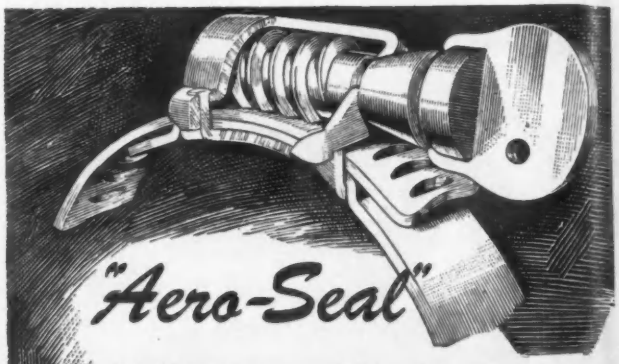
★NEW CATALOG
With Many Helpful Data

FOR VICTORY BUY WAR BONDS AND STAMPS

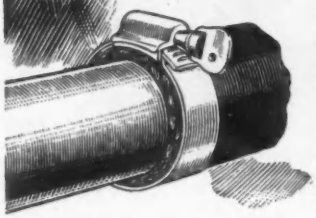
★Includes:
Illustrations of 71 "specials".
Dec. equivs. of fractions.
Weights per 1M pieces.
SENT ON REQUEST

Special heads, threads, and finishes—on fastenings of any metal or alloy adapted to cold-upset—are Progressive's specialty. Weekly output: 25,000,000.

The PROGRESSIVE MFG. CO.
TORRINGTON 38 NORWOOD ST. CONNECTICUT



"Aero-Seal"
HOSE CLAMPS



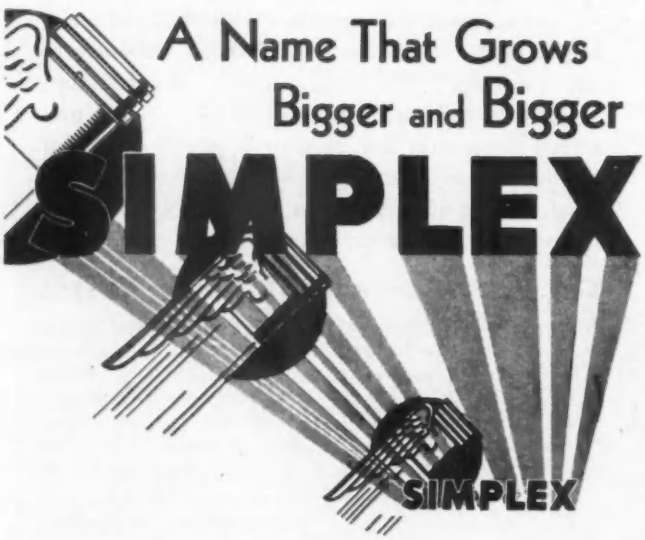
Distinctive worm gear tightening action provides powerful belt-like pull-up. Uniform pressure all around prevents leaks. Can be put on or taken off hose in place on pipe. Can be re-used. No loose parts. Compact design. Extremely long take-up. Made in sizes from ½" up. *Write for circular.*

AIRCRAFT Standard PARTS CO

Proved outstandingly reliable in severe service on aircraft fuel, oil, and coolant lines.

Aircraft Standard Parts Co.
1717G NINETEENTH AVE., ROCKFORD, ILL.

A Name That Grows Bigger and Bigger
SIMPLEX



Higher R.P.M.'s and increased driving speeds created new problems in oil control and compression sealing. Engineers designed more ring grooves in pistons and narrowed the faces of the rings.

Simplex went further—achieved the ultimate; introduced the *first* expander laminated rings. Narrow sections (1/32") gave multiple wiping edges—multiple sealing faces. Utmost flexibility is provided by the individual breathing action of each section.

Simplex achieved another notable *"first"*! When you replace piston rings or recondition a motor, be sure you install rings "Made by Simplex."

"FLYING PISTON"
SIMPLEX RINGS
SIMPLEX PRODUCTS CORP., 3820 Kelley Ave., Cleveland, O.

The Post Office Requests

—that you include *your Postal Zone Number* in the signature of all your advertisements, if you are in a city or town that has been zoned.

This will help speed delivery of inquiries addressed to you from the readers of—

AUTOMOTIVE and AVIATION INDUSTRIES
A CHILTON Publication
Chestnut & 56th Sts. Philadelphia 39, Pa.

Specify B&L GROUND SHAFTING

For Efficient Transmission of Power

Extreme precision in automotive construction, *plus* smooth, vibration-free operation, can be readily obtained in using B&L Ground Shafting . . . as typified by this *drive shaft*, fabricated from Annealed, Cold Finished, Ground Shafting.

B&L Quality Shafting is produced to either standard or special accuracy, as the application may require . . . Cold Drawn, Ground and Polished; or Turned, Ground and Polished. Available in standard grades: as-rolled, heat tregted, Strain-Tempered, or annealed.

ARMY NAVY

Buy more Bonds than Before . . . and help end the War.

BLISS & LAUGHLIN, INC.

HARVEY, ILL. Sales Offices in All Principal Cities BUFFALO, N. Y.

THIS IS OUR JOB!

ATLAS DROP FORGINGS

ATLAS DROP FORGE CO.
LANSING 2 MICHIGAN

Machining to Infinitesimal Tolerance Limits

AIRCRAFT engines and other instruments of war would not be the precision mechanisms that they are today, were it not for the machining of vital parts to tolerance limits that closely approach the infinitesimal.

As specialists in this exacting field, we shall be glad to serve you as soon as war-work permits if you are developing a postwar product that requires machining or experimental work of a highly delicate character.

Write Us Concerning Your Requirements.

THE GOVRO-NELSON COMPANY

1931 Antoinette Detroit 8, Mich.

Quikcet

Ground Clamp

Heavy Duty Speed

GRAND Speed CLAMPS

Keeping 'em Flying!

From Airports at Home as well as on Battlefronts Abroad . . .

QUIKCET—For fast (4-second) clamping. Instant ratchet set and release—fulcrum screw tightening — one-hand operation — non-creeping grip, even on irregular surfaces.
DUAL GRIP—Double action—side tightening for close working conditions. No twisting or creeping.
ALLOY STEEL—Medium and heavy service "C" Clamps of even greater than forged clamp capacity.
GROUND CLAMP — Completely copper plated with connection for ground wire.
QUICK LOCKCET—For light, fast work on aluminum and soft metals. Locking lever and instant trigger release.

Prompt Shipment—Write for Catalog

Alloy-Steel

Dual Grip

Quick Lockcet

GRAND SPECIALTIES CO., 3113 W. Grand Ave., Chicago 22, Ill.

Do You Need Trained Help?

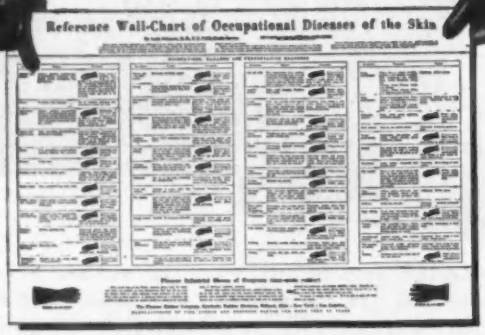
For 40 years we have been training and placing men for repair, maintenance, installation and operation of DIESEL and other internal combustion engines. Write and tell us about the jobs you have open. Whether in immediate need of help or not, registering your company with our Placement Service gives you first choice of available National trained men in your vicinity.

NATIONAL SCHOOLS

Established 1905

4000 South Figueroa Street, Los Angeles 37, California

This Valuable Chart *FREE*


Reference Wall-Chart of Occupational Diseases of the Skin

for your plant dispensary wall

This chart by Dr. Louis Schwartz, M. D., of the U. S. Public Health Service, lists occupational skin diseases, hazards and prevention. Size 34" x 22½", easy to read, handy on your plant dispensary, hospital or safety director's wall. Shows application of Stanzoil neoprene gloves that protect hands better 3 to 7 times longer in oils, acids, caustics. Chart is *Free* — write for your copy today.

STANZOIL PIONEER

Synthetic Rubber Division

THE PIONEER RUBBER COMPANY

269 Tiffin Rd., Willard, Ohio, U.S.A.

New York · Los Angeles

MADE WITH DU PONT NEOPRENE

For Trucks That Must "Take It"

—and Diesel Power Units

Newly developed facilities required to meet the exacting needs of the world's toughest customer for power transmission control in heavy-duty trucks, tractors and other war machines, have produced more rugged and DEPENDABLE types and sizes of

ROCKFORD CLUTCHES and POWER TAKE-OFFS

With men staking their lives on the reliability of power transmission, all "maybe" has been engineered out of power units going into war machines. And one day, this new degree of ruggedness and dependability will help improve oil field prospecting, drilling, pumping, hoisting, current-generating and back-filling equipment.

There is no priority on planning. Now, when you are designing your post-war models, is the time to let our engineers give you the benefit of their war-gained experience. Their recommendations will help you specify clutches and power take-offs that will give your peace-time equipment competitive construction advantages that will help keep your plant busy.

SEND FOR THESE HANDY BULLETINS ON POWER TRANSMISSION CONTROL

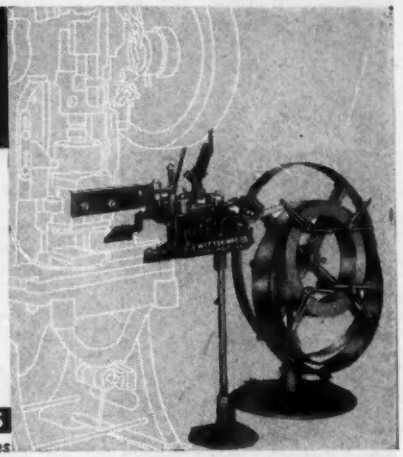
Show HOW the money-saving advantages of ROCKFORD CLUTCHES and Power TAKE-OFFS improve the efficiency and economy of power units. Give capacities, dimensions, shaft sizes, types of bearings and other needed specifications.

Rockford Drilling Machine Division *Borg-Warner Corporation*

315 Catherine Street, Rockford, Illinois, U. S. A.

Pullmore Clutches are sold by Morse Chain Co. offices in principal cities

Our Punch Presses Are More Flexible And Productive With WITTEK *Automatic* Roll Feeds And Reel Stands



Manufacturers of metal stampings facing problems in the feeding of coiled strip stock to punch presses will find that Wittek Automatic Roll Feeds and Reel Stands conserve man-hours and achieve new high production levels. Providing an improved and simplified method of punch press operation, Wittek Automatic Roll Feeds and Reel Stands insure rapid, safe and accurate feeding under all conditions. Made in four different types to meet all automatic feeding requirements. Write for complete details. Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago, Ill.

ARMY E NAVY

WITTEK *Automatic*
ROLL FEEDS and REEL STANDS
For All Makes and Sizes of Punch Presses

FITZGERALD

GASKETS
GREASE RETAINERS
OIL SEALS
GASKET PACKING MATERIALS

•

Gasket Craftsmen
for 38 Years

Gaskets of all types and materials

•

The
FITZGERALD MANUFACTURING CO.
TORRINGTON, CONN.

Branches at Chicago and Los Angeles
Canadian FITZGERALD Limited, Toronto

FITZGERALD
SINCE 1906 **GASKETS**
THE COMPLETE LINE THAT COMPLETELY SATISFIES

New **SAW-GUN**
PORTABLE POWER SAW AND FILE

- CUTS ALL METALS—WOOD—PLASTICS
- SAWS AND FILES IN INACCESSIBLE PLACES
- OPERATES BY ELECTRICITY—FLEXIBLE SHAFT—AIR
- SIMPLE AND EASY TO USE—LIBERALLY GUARANTEED

SEE YOUR JOBBER OR WRITE DIRECT

Mid-States **EQUIPMENT CO.**
Saw-Gun Division
2430 SOUTH MICHIGAN AVENUE, CHICAGO 16, ILLINOIS

ALWAYS A SOURCE OF SUPPLY

For Machine Tools, Stamping Presses, Structural Machinery, Forging Equipment, Hydraulic Equipment, Air Compressors, Production Equipment.

OUR SERVICES ARE ALWAYS AT YOUR DISPOSAL

EMERMAN MACHINERY CORP. 875 W. 120th ST., CHICAGO 43, ILL.

Electro
ELECTRICAL AND RADIO EQUIPMENT

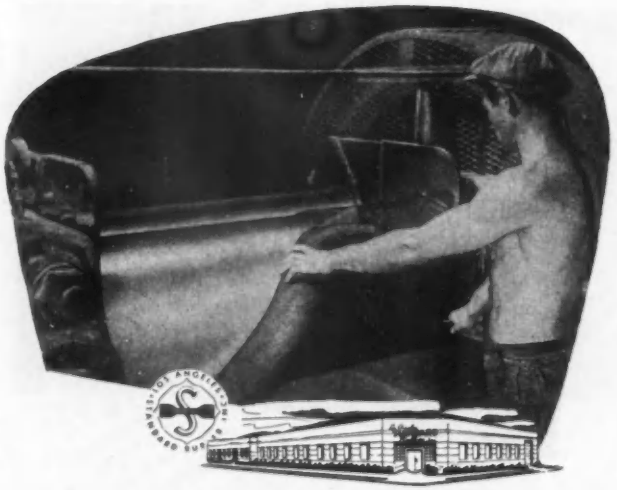
New Improved Pick-Up No. 3000B

High Sensitivity • Constant Polarity • Operates at High Temperatures

The new improved ELECTRO Pick-Up No. 3000B has a bayonet type socket which provides quick, reliable contact between connection cable and pick-up. Adaptor adjustments are much simpler because of 2 new set screws which replace the older type hexagonal nut. This new construction permits easy installation and removal from the engine with an ordinary socket wrench.

The pick-up coil has special impregnation that withstands continuous operating temperatures of 350°. Engineered to provide quick replacement of diaphragm or coil for extra economical operation and long life. When used with ELECTRO Intergrator, will provide indication of pressure variations in reciprocating engines, pumps, etc.
Write for further information.

ELECTRO PRODUCTS LABORATORIES • **549 WEST RANDOLPH ST., CHICAGO 6, ILLINOIS**



Controlled Rubber

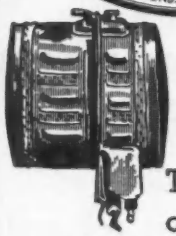
MANUFACTURED TO YOUR SPECIFICATIONS

New techniques developed to meet the exacting demands of war will later be available to improve commercial products. We will be glad to help *now* in solving the rubber problems for your developments of tomorrow.

Los Angeles
STANDARD
Rubber, Inc.

1500 East Gage Avenue • Los Angeles 1, California

MERCURY AIRCRAFT
At The Cradle of Aviation
HAMMONDSPORT / NEW YORK



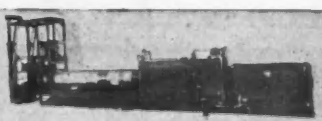
Fuel Tanks

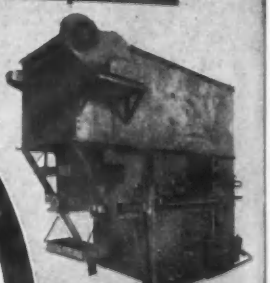
The making of aluminum tanks... for gas, oil and other aircraft requirements . . . forms an important part of Mercury production to which one entire plant is devoted.

MERCURY AIRCRAFT INC.
AIRCRAFT SURFACES • FUEL TANKS
PARTS • ACCESSORIES
AT *The Cradle of Aviation*
HAMMONDSPORT / • NEW YORK

METAL PARTS WASHERS AND DEGREASING MACHINES

Here are a few of the Blakeslee *engineered-for-you* metal parts washing and degreasing machines that are speeding up painting, assembly, plating, finishing and inspection operations in plants throughout the country. Let us show you how Blakeslee equipment will do a thorough job of removing oil, chips and drawing compound from all metal parts in your plant so that big gains can be made in your production schedules. *Wire us details for urgent proposals.*





G. S. BLAKESLEE & CO. • MAIN OFFICE & WORKS • CICERO STATION CHICAGO • NEW YORK • TORONTO

WHITNEY-JENSEN PRODUCTS
30 YEARS EXPERIENCE

TOGGLE-ACTION
FOOT PRESSES
7" 10" 18" 24" THROAT DEPTHS

A powerful linkage MULTIPLIES foot pressure for fast, easy punching and forming work. No kick or violent force is required, steady pressure produces a force of up to 3½ tons per square inch at the point of punching. Capacity 2" hole in 16 ga. iron, 100 holes per minute or better. A light, sturdy machine for short or long-run jobs.

NO. 38 BENCH PUNCH

A small, powerful, throatless-type shear with capacity up to 3/16" mild steel. Cam action provides straight up-and-down blade travel. Length of blade 5". Size, overall, 11" x 8¾" x 7½". Weight 45 lbs. All parts interchangeable for easy replacement.

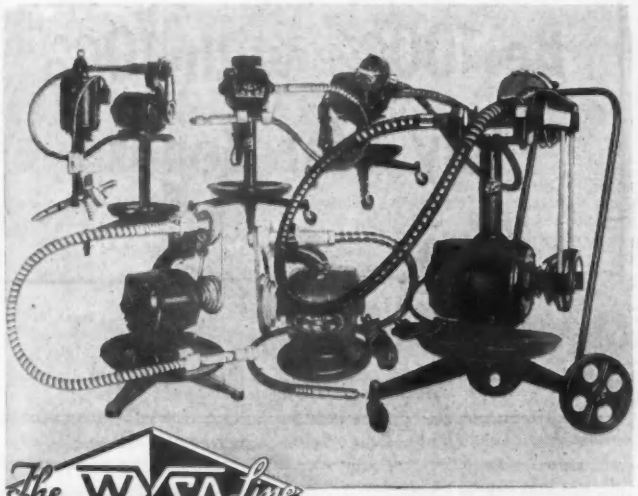
Write for new
PUNCH and DIE CATALOG

WHITNEY METAL TOOL COMPANY
190 FORBES ST. • ROCKFORD, ILL.

LET MERZ MAKE THE PRECISION PARTS!

• Our new modern plant is equipped with the world's finest precision machines and tools. Our engineering staff and machine operators are highly skilled artisans. We can handle the complete job, from drafting board to contract manufacturing, or furnish the special or standard gages, fixtures and tools you require. Write for new literature, and explain your problem.

MERZ *Engineering Company*
INDIANAPOLIS 7, INDIANA



The WYCO Line

Whatever your requirement in a Flexible Shaft Machine

The Wyco line carries a complete range of rugged, dependable units to fit any production need. The Wyco line is on the aircraft and armament front NOW, and doing a civilian production job as well — but for the post war era—for even greater demands—the Wyco line will be geared up for 100% satisfaction in any situation where heavy, medium or light duty production is desired.

Single and Multiple Speed Floor, Bench and Suspension Models, as well as Multiple Speed Jack Shaft and Radial Type Machines, all carrying the Wyco Guarantee for materials and workmanship, are setting records for longer shaft life and greater production. Distributed through Jobbers

WYCO Patented Non-Metallic Innerliner.
Makes the Core last longer —Run smoother — Transmit more power.

Send for our New Catalog

WYZENBEEK & STAFF, INC.
838 W. Hubbard St. Chicago 22, Ill.

SpeedWay

1" DRILL
½ $32.50
With Jacobs Chuck

MORE DRILL
for the money

The last word in ½" capacity drills with very advanced feature. Powerful specially designed Universal Motor pours power thru triple reduction hardened steel gears. Forced air cooling prevents overheating. Housing is sturdy, light weight die casting. Self-aligning porous bronze bearings soak up oil like a sponge; release it slowly as bearing temperatures change. New type "in line" rear grip makes it natural to drill straight holes. One handle removable for close quarter drilling. Light weight (only 10¼ lbs.) means easy handling, yet it is so powerful that it will drill a ½" hole in iron with 500 lbs. weight on the bit. Jacobs key operated chuck. This is not a heavy duty production line tool, but it will give exceptional service to the garage man, maintenance man, contractor or installer.

SPEEDWAY MANUFACTURING CO.
1872 S. 52nd Ave. Cicero 50, Illinois

NEW PRODUCTS — NEW IDEAS

A large manufacturer now engaged exclusively in defense work, wants large production items for post-war development.

We can furnish Engineering, Financing, Manufacturing, Selling

Many sound products or ideas never get past the model stage, due to a lack of one or more of the above essentials. Why not contact a strong company able to supply all of the above facilities within the one organization? If your proposition meets the requirements of soundness and practicability, we would like to discuss it with you. Before sending your drawings to us or anyone else, protect yourself by having copies of them witnessed and the originals retained in your possession. The date of witnessing should be kept confidential by you, as this is the date on which you can prove priority.

AERO SUPPLY MFG. CO., INC., Corry, Pa.

For Ignition Switch Service; Directional Switches; Dove Tails
MITCHELL DIVISION
Philadelphia, Pa.

Air Cleaners—Oil Bath and Pre-Cleaners for Engine Protection
UNITED AIR CLEANER DIV.
Chicago, Ill.

Divisions of
UNITED SPECIALTIES COMPANY
9705 Cottage Grove Ave. Chicago, Ill.

STAMPINGS

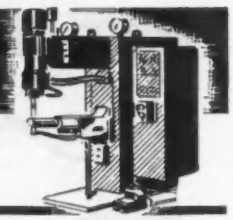
WORCESTER STAMPED METAL — QUALITY STAMPINGS

Heavy, medium and light stampings in any quantity. A steady flow of production—*when* you want it.

WORCESTER STAMPED METAL CO.
9 Hunt Street, Worcester, Mass.

WORCESTER STAMPED METAL — QUALITY STAMPINGS

SCIAKY
4915 W. 67TH ST., CHICAGO, ILL.



Manufacturers of a complete line of AC & DC Electric Resistance Welding Machines.

Watch page 9, next issue, for our full page advertisement.

New . . . ★MASTER SEAL★
SHAFT SEALING UNITS

A self contained self aligning, tamper proof, low loss, SHAFT SEAL for rotating shaft. Easily installed or replaced. Made in two styles—flange type shown or press type assembled in a pressed steel case. Adaptable for use in Aircraft Electric Motors, Oil Pumps, Gasoline Pumps, Hydraulic Equipment and accessory drive shafts. Will design for your needs. Write today for complete information.

FEDERAL SEAL CO., Kendallville, Indiana, U.S.A.

STAMPINGS capacity available for high speed production of small stampings.

AMERICAN METAL WORKS, Incorporated
1537 Germantown Avenue, Philadelphia 22, Pa.

VICTOR
GASKETS
OIL SEALS
GREASE RETAINERS

Tool Designing Engineers
BERG ENGINEERING SERVICE
DETROIT — 8718 Mack Avenue, Ph. Plaza 2920
CHICAGO — 166 W. Jackson Blvd., Ph. Wabash 7087

AIRCRAFT *Anti-Vibration* LITTELFUSES

For severest service. Locked Cap Assembly—Vibration-Resisting Elements—Anti-Contraction—Expansion. Fuses for all instruments, high, low voltage, inst., aircraft, communications, engine circuits, radio, automobile, auto radio, clips, mountings, panels. **Send for Catalog.**

5 AG Anti Vibration Littelfuses

WRITE FOR CATALOG

LITTELFUSE INC. 4731 Ravenswood Av., Chicago, Ill. 201 Ong St., El Monte, Calif.

JOHN CRANE *Bellows*
PUMP SEAL
Designed for AIRCRAFT, MARINE, JEEP, TRUCK, TRACTOR AND AUTOMOBILE PUMPS

CRANE PACKING COMPANY 1818 CUYLER AVE. CHICAGO 13, ILL.

★

Be 100% with 10% Buy War Bonds

★

Classified Advertisements

Wanted: Sales Engineer in Tubing Industry who is familiar with chrome nickel alloys. Statement of availability required. Address Box 41, Chilton Compny, Chestnut & 56th Sts., Philadelphia 39, Pa.

WANTED—DRAFTSMAN ENGINEER. EXPERIENCED. MECHANICAL—AUTOMOTIVE & ELECTRICAL APPLIANCES. STEADY POSITION POST-WAR. GOOD OPPORTUNITY ADVANCEMENT. METROPOLITAN NEW YORK AREA. Send full resume, photograph (not returnable) and salary desired. Statement of Availability required. Write Box 403, Equity, 113 West 42nd St., N.Y.C.

WANTED: SERVICE TRAVELLER to cover service matters with distributors on new Hydraulic Brake Boosters and other Automotive Equipment. Excellent position with good future assured. Box 39, Chilton Company, Chestnut & 56th Streets, Philadelphia 39, Pa.

B-H

MANUFACTURERS OF SHEET METAL AND TUBULAR ACCESSORIES

CONTRACTORS TO ALL LEADING ENGINE AND PROPELLER MANUFACTURERS

ALUMINUM TANKS

B-H AIRCRAFT CO., Inc. LONG ISLAND CITY 1, NEW YORK

Why the Vertical Roto-Matic Will Increase Your Drilling Production

. . . is explained in this **FREE BOOKLET**

The ROTO-MATIC principle of continuous operations will enable you to drill, ream, bore, face, mill, etc., more parts in less time. Write for this booklet today; learn the many advantages of the ROTO-MATIC and how it can be specifically applied to your work. Ask for Bulletin No. D-100.

Davis and Thompson Co.
Mfrs. of Machine Tools and Micrometers
6411 W. Burnham St. • Milwaukee 14, Wisconsin

Do You Know *ALL of the Advantages* OF INFRA-RED RAY DRYING WITH NALCO DRITHERM CARBON FILAMENT LAMPS?

Radiant Energy Drying, baking, heating and dehydrating is the modern method—cuts drying cost, saves time, uses minimum space, produces uniform results.

Available in Inside-Silvered (self reflecting) or clear glass types.

Learn all of the advantages of the Infra-Red process—Write for your free copy of "Drying Problems Made Easy" today.

North American Electric Lamp Co.
1022 Tyler Street St. Louis 6, Missouri

PJ

. . for over 40 years
THE PIONEER MANUFACTURER OF
AUTOMATIC CHUCKING EQUIPMENT

POTTER & JOHNSTON MACHINE CO.
PAWTUCKET, RHODE ISLAND

FELT

Only first rate FELTS, meeting required specifications and tests, will function properly. Substitutes will not do. Check this with your engineers . . . then buy FELT with confidence.

American Felt Company
TRADE MARK
General Offices: GLENVILLE, CONN.

New York Boston Chicago Detroit Philadelphia St. Louis
Cleveland Los Angeles San Francisco Dallas Seattle

DIAMONDS for Victory

BIG-HED-NIBS
LOC-KEY-SET

RE-SET-ABLE
Means more for your money. Prolongs the life of diamond dressers.

● Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. (24 hour resetting service, $1.00 post paid.)

Distributed thru Mill Supply Jobbers.
Write for Free Grinder's Instruction Card and Catalog

DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, Pres.
938 E. 41st Street CHICAGO, ILL.

PRACTICE FROM BLUE PRINTS!

Become a Specialist in Essential Industry!

SUGGESTED SHOP PROBLEMS

A most practical and timely shop manual that will never get out of date. Contains 104—8½x11" pages, spiral bound—60 easy-to-read projects—78 blue prints—six groups of simple procedures. Convenient for home, shop or school use.

Abundant with up-to-date shop ideas for defense contract jobs, aircraft maintenance, sheet metal replacement parts, machine shop bench hand work on small hand working fixtures, and other useful data on BLUE PRINT READING, sheet metal drafting, layouts, pattern making, precision hand filing, assembly, riveting, etc.

An Indispensable Reference Guide for many shop uses and a full year's practice course compiled into this practical manual.

Shipped postpaid at $3.75

THE METAL CRAFTS GUILD
Dept. 17, P.O. Box 142, Flatbush Station, Brooklyn 26, N. Y.

INDIA NOW and POST-WAR

To manufacturers of aircraft, aero engines, aeronautical equipment, accessories including aviation, radio, aerodrome lighting and kindred lines The Asian Air Associates—a Company well-founded and financially sound—are prepared to consider the exclusive agency for or sub-licences to manufacture—their manufactures in British India. The Asian Air Associates are planning a chain of maintenance stations at the major air ports in India which places them in an unique position to represent Air Lines and undertake the maintenance of aircraft.

Bank and other references submitted.

Communicate direct to:

THE ASIAN AIR ASSOCIATES
Wavell House, 15 Graham Road, Ballard Estate, Fort, Bombay

A-C Spark Plug Div. —
Abrasive Company —
Abrasive Dressing Tool Co. —
Abrasive Machine Tool Co. —
Acadia Div. Western Felt Works. 116
Accurate Spring Mfg. Co. 50
Ace Mfg. Corp. —
Acheson Colloids Corp. —
Acme Pattern & Tool Co., Inc. —
Adel Precision Products Corp. 55
Aero Screw Company. 103
Aero Supply Mfg. Co., Inc. 228
Aeroproducts Div. G.M. Corp. —
Aeroquip Corporation 160
Aetna Ball Bearing Mfg. Co. —
Ahlberg Bearing Company 3
Air-Maze Corp. 136
Air Reduction Sales Co. —
Aircraft Accessories Corp. 94-95
Aircraft & Diesel Equip. Corp. 214
Aircraft-Marine Products, Inc. 129
Aircraft Nut Corp. —
Aircraft Screw Products, Inc. 145
Aircraft Standard Parts Co. 222
Ajax Electrothermic Corp. —
Ajax Manufacturing Co., The —
Allegheny Ludlum Steel Corp. —
Allied Products Corp. —
Allison Div., General Motors 155
Aluminum Co. of America 77
Aluminum Industries, Inc. 180
Alvey-Ferguson Co., The —
American Air Filter Co., Inc. 62
American Bosch Corp. 57
American Brake Shoe Co. —
American Brakeblok Div. —
American Broach & Machine Co. —
American Chain & Cable Co., Inc. 66-139-150
American Chemical Paint Co. 177
American Coil Spring Co. —
American Felt Co. 229
American Hammered Piston Ring Div. Koppers Co. 151
American Metal Works, Inc. 228
American Screw Co. —
American Steel & Wire Co. —
American Tube Bending Co., Inc. 210
Anchor Post Fence Co. —
Andover Motors Corp. 201
Arens Controls, Inc. 74
Arkansas Fuel Oil Company —
Armstrong Cork Co. 115
Aro Equipment Corp. —
Arrow Safety Device Co. —
Arter Grinding Machine Co. 122
Asian Air Associates, The 229
Associated Spring Corp. —
Atlas Drop Forge Co. 223
Auto Specialties Mfg. Co. —
Automatic Transportation Co. 203
Automotive & Aircraft Div. American Chain & Cable Co., Inc. 150

B-H Aircraft Co., Inc. 229
Bakelite Corp. (Plastic Div.) —
Baker Brothers, Inc. —
Baker Ind. Truck Div. Baker-Raulang Co. 54
Baldwin Southwark Div. 193
Bantam Bearings Div., The Torrington Co. —
Barber-Colman Co. 232
Bardwell & McAllister, Inc. —
Barnes Co., W. F., & John 158
Barnes-Gibson-Raymond Div. Associated Spring Co. —
Bauer & Black Div. The Kendall Co. —
Bearings Co. of Amer. 161
Bendix Aviation Corporation
Bendix Products Div. 186
Eclipse Machine Div. —
Bendix-Westinghouse Automotive Air Brake Co. 144
Berg Engineering Service 228
Bethlehem Steel Co. 199
Bijur Lubricating Corp. —
Birdsboro Steel F'dry & Mach. Co. 205
Black & Decker Electric Co. 60
Blakeslee & Co., G. S. 226
Blanchard Machine Co., The —
Bliss & Laughlin, Inc. 223
Boots Aircraft Nut Corp. 134
Borg & Beck Div. Borg-Warner 80
Borg-Warner Corp. 71
Bower Roller Bearing Co. —
Bridgeport Fabrics, Inc. —
Bridgeport Thermostat Co. 117
Bristol Co., The —
Brush Development Co., The —
Bryant Chucking Grinder Co. —
Buell Manufacturing Co. 76
Bullard Co., The —
Bulldog Electric Products Co. —
Bundy Tubing Co. 5
Bunting Brass & Bronze Co. —
Burdett Manufacturing Co. —
Burgess-Norton Mfg. Co. —

Camloc Fastener Corp. 165
Campbell, Andrew C., Div. Amer. Chain & Cable Co., Inc. 66
Campbell, Wyant & Cannon Foundry Co. —
Cannon Electric Development Co. 192
Carboloy Co., Inc. 140
Cardox Corp. —
Carnegie-Illinois Steel Corp. 130
Carpenter Steel Co., The 45
Celanese Celluloid Corp. —
Central Equipment Co. 84
Central Screw Co. —
Chace Co., W. M. —
Chambersburg Engineering Co. 220
Chandler Products Corp. —
Chicago Rawhide Mfg. Co. 87
Chicago Screw Co., The 72
Chicago Show Printing Co. 142
Chrysler Corporation —
Cincinnati Milling Machine Co. —
Cities Service Oil Co. —
Clark Equipment Co. —
Clark Trucktractor Div. —
Clayton Mfg. Co. 70
Clearing Machine Corp. 121
Cleveland Pneumatic Tool Co. —
Clifford Mfg. Co. —
Climax Molybdenum Co. 41
Cold Metal Products Co., The —
Columbia Steel Co. 130-195
Cone Automatic Machine Co., Inc. —
Consolidated Vultee Aircraft Corp. —
Continental-Diamond Fibre Co. —
Continental Motors Corporation —
Continental Rubber Wks. 86
Continental Screw Co. —
Corbin Screw Corp., The —
Cotta Transmission Corp. —
Crane Packing Co. 228
Cullen-Friedstedt Co. —
Cunningham Co., M. E. —
Curtis Pneumatic Mach. Div. 215

Danly Machine Specialties, Inc. 170
Dardelet Threadlock Corp. —
Davis & Thompson Co. 229
Dazor Manufacturing Co. —
Dearborn Gage Co. —
De Bothezat Div. of American Machine & Metals, Inc. —
Deepfreeze Div. Motor Products Corp. 208
Denison Engineering Co., The —
Designers for Industry, Inc. —
Detrex Corporation 96
Detroit Broach Company 128
De Walt Products Corp. —
Diamond Tool Company 229
Dings Magnetic Separator Co. 58
Disston & Sons, Inc., Henry 209
Do All Company, The 143
Dole Valve Co., The 184
Dow Chemical Co., The 51
du Pont de Nemours & Co. (Inc.) 65-147
Duro Metal Products Co. 172
Dykem Co., The —
Dynamic Air Engrg., Inc. —

Eaton Mfg. Co. —
Elastic Stop Nut Corp. of America —
Electric Auto-Lite Co. —
Electric Furnace Co., The 108
Electric Storage Battery Co. —
Electrix Corp. 120
Electro Metallurgical Co. 204
Electro Products Laboratories 226
Emerman Machinery Corp. 225
Emerson Electric Mfg. Co., The —
Empire Electric Brake Co. 166
Equitable Bearing Co., Inc. 88
Ex-Cell-O Corp. 102

Fairfield Mfg. Co. —
Federal-Mogul Corp. 187
Federal Press Co., The —
Federal Seal Co. 228
Felters Co., The —
Fenn Aircraft Div. —
Firestone Industrial Products Co. 141
Fischer & Porter Co. —
Fisher Furnace Co. 217
Fitchburg Grinding Machine Corp. —
Fitzgerald Mfg. Co., The 225
Flexotube Company —
Foote Bros. Gear & Machine Corp. —
Formica Insulation Co., The 135
Fostoria Industrial Service 114
Fuller Mfg. Co. 148
Fulton Sylphon Co., The 13

G & O Mfg. Co. —
Gabriel Company —
Gairing Tool Co., The —
Galland-Henning Mfg. Co. 4
Garrett Co., George K. —
Gear Grinding Machine Co. 126
Gemmer Mfg. Co. —

Index to

The Advertisers' Index is published of the advertising contract. Every rectly. No allowance will be made

General Aniline & Film Corp. —
General Controls 106
General Electric Co. —
General Machinery Corp. —
Gibson Company, Wm. D. —
Gisholt Machine Co. 9
Gite Bros. Mfg. Co. 163
Globe Steel Tubes Co. —
Govro-Nelson Co., The 223
Grammes & Sons, Inc., L. F. 215
Grand Specialties Co. 224
Great Lakes Steel Corp. 171
Greenlee Bros. & Co. —
Grizzly Mfg. Co. 64
Guiberson Diesel Engine Co. —

Hall Mfg. Co. —
Hansen Mfg. Co. 61
Harper Co., The H. M. —
Harrisburg Steel Corp. —
Hayes Industries, Inc. 99
Heald Machine Co., The 2nd Cover
Herbrand Corporation, The 98
Hercules Powder Co., Inc. 105
Hills-McCanna Co. 85
Hollingshead Corp., R. M. 146
Holliston Mills, Inc., The —
Hooven, Owens, Rentschler Co. —
Hoover Ball & Bearing Co. —
Hotel Pittsburgher —
Houdaille-Hershey Corporation 206
Houghton & Co., E. F. —
Howell Electric Motors Co. —
Hyatt Bearings Div. G. M. Corp. 7
Hycar Chemical Co. 200
Hydraulic Machinery, Inc. —
Hydraulic Press Mfg. Co., The 52-53
Hydropress, Inc. 101

Independent Engineering Co., Inc. 197
Indium Corp. of America, The 100
Industrial Gear Mfg. Co. —
Inland Mfg. Div. G. M. Corp. 190
Inland Steel Co. 39

International Nickel Co., Inc., The 113
International Plastic Corp. 216
International Screw Co. —

Jenkins Bros. —
Jessop Steel Co. 149
Johnson Bronze Co. 110
Jones & Lamson Machine Co. —

Kay Products Company —
Kearney & Trecker Corp. 75
Kempsmith Machine Co. 63
Kester Solder Co. —
King-Seeley Corp. —
Kling Bros. Engrg. Wks. 56
Kold-Hold 118
Koppers Co. 151
Kropp Forge Aviation Co. 137

Ladish Drop Forge Co. 159
Lamson & Sessions Co. —
Lapointe Machine Tool Co. —
Lawson Machine and Tool Co. —
Layne & Bowler, Inc. —
Lear Avia, Inc. —
LeBlond Machine Tool Co., R. K. Back Cover
Leeds & Northrup Co. 119
Libbey-Owens-Ford Glass Co. 191
Lift Trucks, Inc. 217
Lincoln Electric Co., The 68-69

Advertisers

as a convenience, and not as part care will be taken to index cor- for errors or failure to insert.

Lincoln Engineering Co. 189
Lincoln Park Industries, Inc. 194
Lindberg Engineering Co. 2
Lister-Blackstone, Inc. —
Littelfuse, Inc. 228
Lodge & Shipley Mach. Tool Co. 47
Logan Engineering Co. —
Long Mfg. Div. Borg-Warner Corp. 97
Los Angeles Standard Rubber, Inc. 226

McAleer Manufacturing Co. 188
McCulloch Engineering Corp. —
McQuay-Norris Mfg. Co. (Aircraft Div.) 59
Magnaflux Corp. 173
Mahon Co., R. C., The —
Mallory & Co., Inc., P. R. 176
Manufacturers Screw Products —
Marman Products Co., Inc. 109
Mathews Conveyer Co. 220
Mechanics Universal Joint Division Borg-Warner Corp. 104
Mercury Aircraft, Inc. 226
Merz Engineering Co. 227
Metal Crafts Guild, The 229
Metal Specialty Co., The —
Metroloy Co. —
Michigan Leather Products Co. —
Michigan Tool Company —
Micromatic Hone Corp. 10-11
Midland Steel Products Co. —
Mid-States Equipment Co. 225
Moline Tool Company —
Moraine Products Div. —
Morse Chain Co. —
Motor Products Corp. 208
Muehlhausen Spring Corp. —
Muskegon Piston Ring Co. 6
Mystik Tape Division Chicago Show Printing Co. 142

National Acme Co., The 138
National Broach & Machine Co. 179
National Schools 224
National Screw & Mfg. Co., The 182
National Steel Corp. 171
National Tube Co. —
New Departure Div. G. M. Corp. —
New England Screw Co. —
Niles Tool Works Co. —
Noblitt-Sparks Industries, Inc. 178
North American Electric Lamp Co. 229
Northern Indiana Brass Co. —
Norton Company —
Nox-Rust Corporation 12

Ohio Rubber Co., The 207
Onsrud Machine Wks., Inc. —
Ozalid Products Div. —

Paasche Airbrush Co. —
Page Steel & Wire Div. American Chain & Cable Co., Inc. —
Palnut Co., The 92
Panelyte Div., St. Regis Paper Co. 174
Parker Appliance Co. —
Parker Co., The Charles —
Parker-Kalon Corp. —
Pawtucket Screw Co. —
Pease Co., The C. F. —
Pedrick Piston Rings 107
Peerless Machine Co. —
Pennsylvania Salt Mfg. Co. 81
Perfex Gage & Tool Co. —
Permatex Co., Inc. 43
Pesco Products Co. 175
Pheoli Mfg. Co. —
Philadelphia Rust Proof Co. —
Phillips Screw Mfrs. —
Physicists Research Co. —
Pierce Governor Co., Inc., The —
Pierce Paper Products Co. —
Pioneer Rubber Co. 224
Pittsburgh Lectromelt Furnace Corp. 202
Pittsburgh Plate Glass Company 198
Pittsburgh Steel Co. —
Porter-Cable Machine Co. —
Potter & Johnson Machine Co. 229
Poulsen & Nardon, Inc. 153
Powder Metallurgy Corp. —
Pratt & Whitney (Division Niles-Bement-Pond Co.) 181
Preis Engraving Mach. Co., H. P. —
Presstite Engineering Co. 169
Progressive Mfg. Co., The 222
Purolator Products, Inc. 192

Racine Tool & Machine Co. —
Ramsey Access. Mfg. Corp. —
Reading Screw Co. —
Redmond Co., A. G. 127
Reeves Brothers, Inc. —
Republic Steel Corp. 183
Resistoflex Corporation —
Reynolds Metals Co. 124
Rhode Island Tool Co. 216
Rhodes & Co., Jas. H. —
Riehle Testing Machine Div. of American Machine & Metals, Inc. —
Rockford Die & Tool Works, Inc. —
Rockford Drilling Machine Div. 224
Rodic Rubber Corp. 167
Rohm & Haas Co. 162
Russell, Burdsall & Ward Bolt & Nut Co. —
Ryerson & Son, Inc., Joseph T. 16

SKF Industries, Inc. —
Saginaw Malleable Iron Div. G. M. —
Sav-Way Industries 132
Scandia Mfg. Co. —
Schrader's Son, A. —
Sciaky Bros. 228
Scovill Mfg. Co. —
Scully-Jones & Co. 212
Sealed Power Corp. 49
Seneca Falls Machine Co. —
Service Caster & Truck Div. Domestic Industries, Inc. 218
Shakeproof, Inc. 8
Sheffield Corp., The 154
Sheldon Machine Co. —
Shore Instrument & Mfg. Co., The —
Shuler Axle Co., Inc. —
Siewek Engineering Div. of Domestic Industries, Inc. 73
Silent Hoist Winch & Crane Co. —
Simmonds Aerocessories, Inc. 111
Simplex Products Corp. 222
Sisalkraft Co., The 221
Snap-on Tools Corp. 123
Snyder Tool & Engrg. Co. 156
South Bend Lathe Works —
Southington Hardware Mfg. Co. —
Speedway Mfg. Co. 227
Spencer Turbine Co., The 112
Sperry Products, Inc. —
Spicer Mfg. Co. —
Spun Steel Corporation —
Square D Company 90
Standard Molding Corp. 218
Standard Oil Co. (Ind.) —
Sterling Aluminum Products, Inc. —
Sterling Tool Products Co. 93
Stow Manufacturing Co. 219
Strom Steel Ball Co. —
Stromberg-Carlson Co. —
Stuart Oil Co., Ltd., D. A. 82
Sturdimatic Tool Co. —
Sturtevant Co., P. A. —
Superior Coach Corp. —

Taylor Fibre Company —
Terry Co., Geo. A. —
Texas Co., The —
Thompson-Bremer & Co. 3rd Cover
Thompson Mfg. Co., Earl A. —
Timken Roller Bearing Co., The Front Cover
Tinnerman Products, Inc. 83
Titeflex, Inc. —
Tobe Deutschmann Corp. 89
Tomkins-Johnson Co. —
Torrington Co., The —
Tourek Mfg. Co., J. J. —
Transue & Williams Steel Forging Corp. —
Tube-Turns, Inc. —
Tubular Alloy Steel Corp. 195
Tung-Sol Lamp Works, Inc. 219
Tuthill Pump Company 220
Tuthill Spring Co. —
Twin Disc Clutch Co. 14

U. S. Automatic Corp. 214
Udylite Corp., The —
Union Carbide & Carbon Corp. —
United Screw & Bolt Corp. —
United Specialties Co. 228
United States Rubber Co. —
United States Steel Corp. 130-195

Van der Horst Corp. of Amer. 91
Vard, Inc. —
Vascoloy-Ramet Corp. 196
Vickers, Inc. —
Victor Mfg. & Gasket Co. 228
Vinco Corporation 168
Visco-Meter Corp. —
Vulcan Corp. —

Wadsworth Watch Case Co., Inc. 211
Waldes-Koh-I-Noor, Inc. 125
Walker-Turner Co., Inc. 221
Ward Products Corporation, The —
Warner Electric Brake Mfg. Co. 133
Watson-Stillman Co., The —
Waukesha Motor Co. 1
Weatherhead Co., The 67
Wells Mfg. Corp. 157
Western Auto. Mach. Screw Co. —
Western Felt Works 116
Westinghouse Elec. & Mfg. Co. 78-79-131
Wetmore Reamer Co. —
Whitaker Cable Corporation 164
White Dental Mfg. Co., The S. S. 152
Whitney Metal Tool Co. 227
Whitney Screw Corp. —
Wilcox Rich Div. —
Wilkening Mfg. Co. 107
Wilson Welder & Metals Co., Inc. —
Wittek Mfg. Co. 225
Wolverine Tube Div. 213
Woodworth Co., N. A. 185
Worcester Stamped Metal Co. 228
Wrigley, Jr., Co., Wm. —
Wright Mfg. Div. American Chain & Cable Co., Inc. 139
Wyman-Gordon —
Wyzenbeek & Staff, Inc. 227

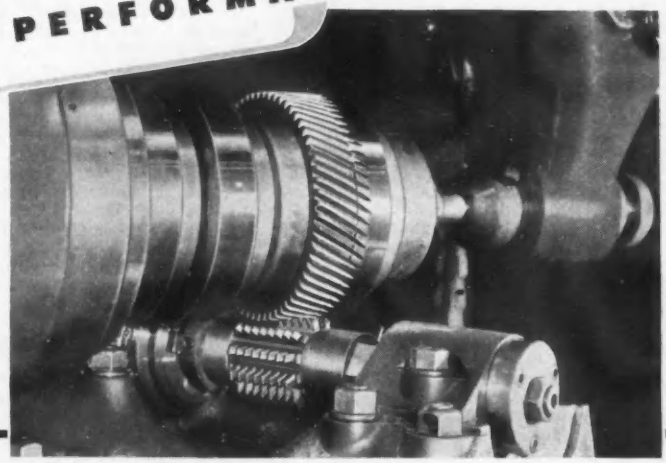
Yoder Co., The —
Young Radiator Co. —
Young Spring & Wire Corp., L. A. —

Zollner Machine Works —

ANOTHER EXAMPLE OF

BARBER-COLMAN

HOBBING MACHINE PERFORMANCE

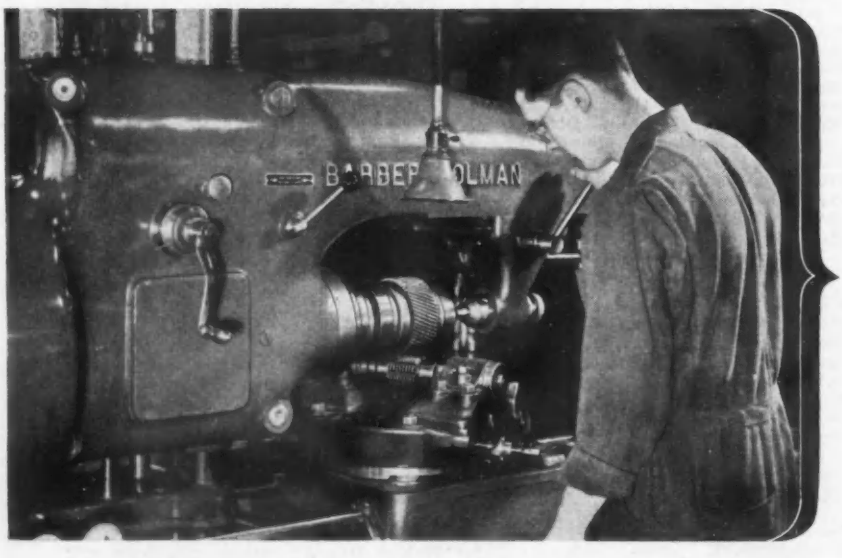


TYPE "D" HOBBING MACHINE

This machine is designed for accurate, heavy duty, high production manufacturing. An outstanding feature is the *hydraulic* drive and clamping mechanism, which produces smoother operation and finer finish on heavy cuts.

HUSKY HELICAL GEARS
FOR MILLING MACHINES . . .

This particular gear calls for a very high degree of accuracy as well as fine finish. The job is hobbed with *one-cut climb hobbing.* Material is SAE 3145 steel with a hardness of 197 Brinell. Two gears, back to back, constitute a load, clamped on a special arbor with supporting collars. Accuracy requirements are good finish and check within .001″/.0015″ runout, +.001″ −.0000″ over pins.



20 GEARS CUT IN 8 HOURS CLIMB HOBBING...GOOD FINISH REQUIRED IN TOUGH MATERIAL

Gear Specifications..10.86 pitch, 6.58″ O.D., 1¼″ face, 64 teeth, 23° helix, 20° P. A., Involute form.
Feed..... .100″ per min.
Feed per Rev. of work..... .040″
Hob Speed..... 103 r. p. m.
Hob.....3″ O. D. x 3″ length x 1¼″ straight hole, ground, single thread, non-topping.
No. of settings..... 2
Pieces per setting..... 12
Pieces per grind..... 24

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

GENERAL OFFICES AND PLANT • 107 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

WHEN LOOSE NUTS AND BOLTS *Are* FATAL

TO DEPENDABLE PERFORMANCE

It's A Job for

• "Everlocking" gives your assemblies extra *staying power.* Note the wide chisel edge construction on the enlarged EverLOCK Washer illustrated above. These chisel edges are forced into the contiguous faces of both work and nut by powerful spring tension . . . providing several times more area of resistance. The effects of vibration and strain are effectively counteracted. Speed of application permits substantial time and labor savings.

Wire, phone or mail your orders today.

Listed on Government Ordnance Standard Prints BEAX 1-2-3-4-7-8-10
Shown on AN936 (Army-Navy Aeronautical Standard)

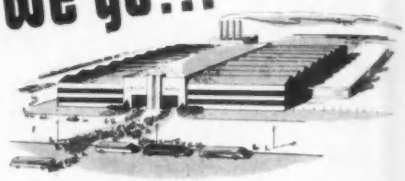
PROMPT DELIVERY ON MOST SIZES

Ever LOCK WASHERS

THE WASHER THAT HAS THE EDGE

HOMPSON-BREMER & CO., 1642 W. HUBBARD ST., CHICAGO 22, ILL.

it's off to ~~war~~ WORK we go...



In September, 1918, Marshall Foch asked the staffs of the American, British and French Armies to report their considered views on the time required to defeat Germany. The most optimistic said one year. Yet in less than three months the war had ended.

Even now the switch from warwork to "peacework" may come more quickly than we dare hope for . . . from high-pressure war production at any cost to steady peacetime production at lowest cost. How to reduce product costs with wage scales remaining high, may not be as difficult as it seems. Other facts, besides wages, affect the selling price. Production equipment is one. The lathe that wastes even the decimal part of your production penny cannot be tolerated.

Wages represent purchasing power. New LeBlond lathes represent economical production. Together — earned wages and low cost machine production — represent post war prosperity. More and better products at less cost for more people is a goal that can be reached. New, improved, cost-cutting LeBlond lathes are available to help you reach it. Use the coupon, below, today!

THE R.K. **Le BLOND** MACHINE TOOL CO., CINCINNATI, 8

NEW YORK 13, 103 Lafayette St. CAnal 6-5281

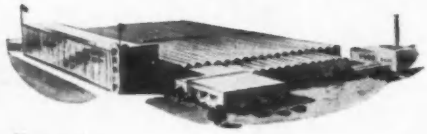
CHICAGO 6, 20 N. Wacker Dr. STA 5561

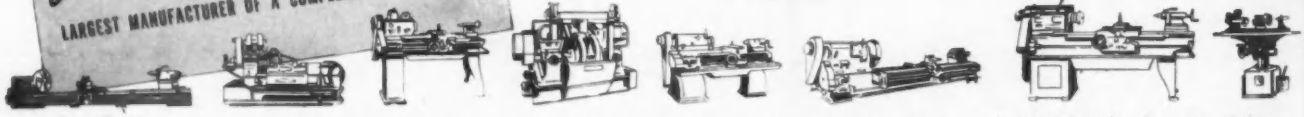
time to retool

Turn to Le Blond for Turning Equipment

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

ARMY E NAVY — LE BLOND — 10





HD Engine Lathes—Nine sizes ranging from 12" to 50" swings. For versatility in turning.

Automatic Lathes—12" & 16" Mechanical or Hydraulic power.

Super Regal Lathes—Six sizes, 13" to 24". Best for training.

Automatic Crankshaft Lathes—For all facing, turning, finishing, pins.

Tool Room Lathes—12", 14", 16" and 18" swings. Versatile.

HD Gap Lathes—Ten sizes in Regular and Sliding Gap models.

Rapid Production Lathes—13", 17", 20" swings. Six speeds. Faster output. Lower cost.

No. 2 Cutter Grinder—Internal, cylindrical, face and angular work.

Check-Clip-Mail

FOR ILLUSTRATED SPECIFICATIONS:

- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
- ☐ TOOL ROOM LATHES
- ☐ AUTOMATIC LATHES
- ☐ HEAVY DUTY GEARED HEAD GAP LATHES
- ☐ SUPER REGAL GEARED HEAD LATHES
- ☐ RAPID PRODUCTION LATHES
- ☐ AUTOMATIC CRANKSHAFT LATHES
- ☐ No. 2 CUTTER GRINDER

YOUR NAME _____ TITLE _____

YOUR FIRM _____ ADDRESS _____

★ YOUR BONDS BUY BOMBS ★

BUY A "BLOCK-BUSTER" TODAY!